June 7, 1944

NATIONAL PETROLEUM NEWS

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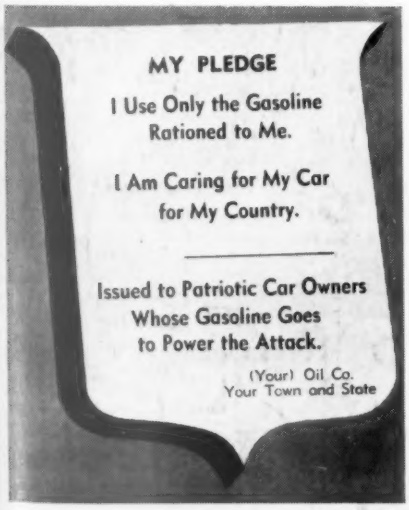
TECHNOLOGY DEPT:

Army's Oil Buyers Are Honored on First Anniversary

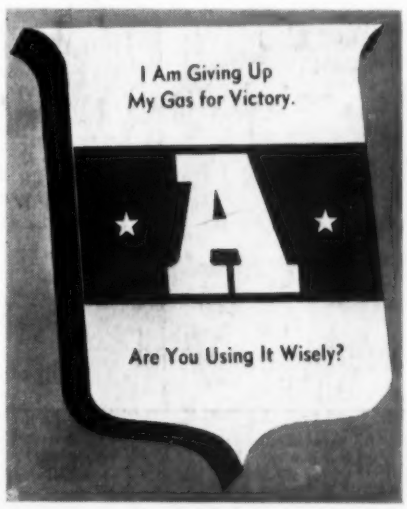
Brig. Gen. H. L. Peckham and branch chiefs of the U. S. Army's Fuels and Lubricants Division are shown here on the occasion of the division's first anniversary June 1. In the background is the all-inclusive petroleum products exhibit donated to the division for the duration of the war by the oil industry. Those shown in the picture are, left to right, Lieut. Col. J. M. Sills, technical branch; Lieut. Col. E. V. Foran, planning branch; Col. Jay L. Taylor, deputy director; Capt. H. M. Fish, control branch; Gen. Peckham; Col. Daniel W. Spurlock, assistant to director; Maj. J. F. Mimnaugh, administrative branch; Lieut. Col. C. R. Mabley, solid fuels branch; Lieut. Col. F. E. Wilder, requirements branch; and Lieut. Col. Royal Linden, operations branch. The division's official task is supervising purchase of all fuels and lubricants for the Army, with the exception of those for the Air Forces aircraft. (See editorial p. 11, story p. 26.)

Enthusiastic Support Given NPN Campaign to Honor Patriotic 'A' Card Drivers

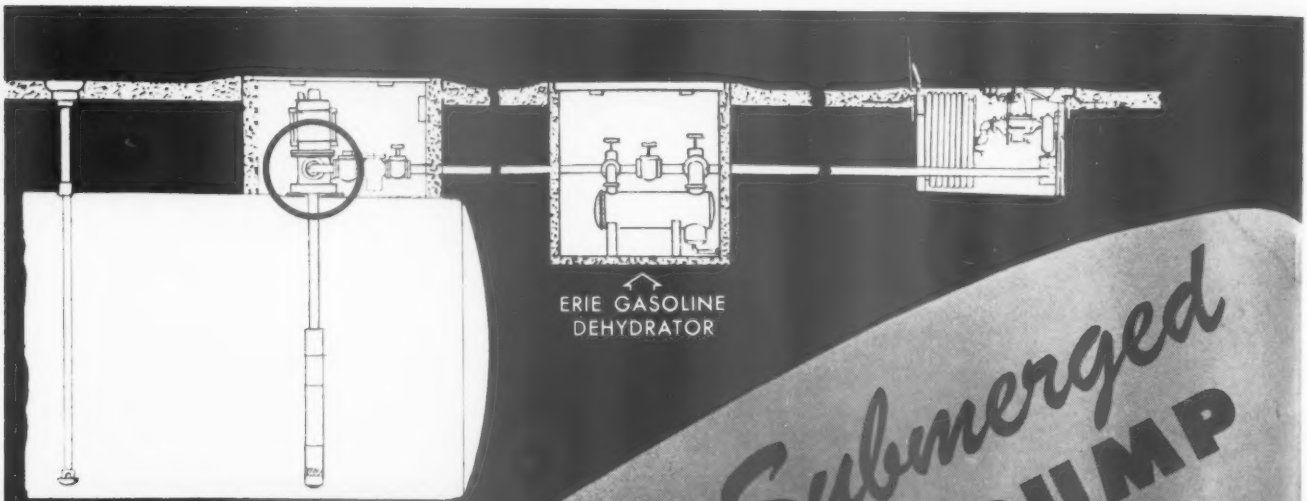

MY PLEDGE
I Use Only the Gasoline Rationed to Me.
I Am Caring for My Car for My Country.
Issued to Patriotic Car Owners Whose Gasoline Goes to Power the Attack.
(Your) Oil Co.
Your Town and State

(Rear View)

The Victory Emblem, sponsored by NPN for the windshields of 11,000,000 automobiles whose owners hold "A" gasoline ration coupons, has already elicited wide and enthusiastic support as a means of serving notice to the public that the owners of such emblems are faithfully backing their country's effort to conserve gasoline for the armed forces. It is an appeal to help crush black market practices and it emphasizes the necessity for patriotic support of the boys who are dying on newly established beachheads on the coast of France or in the jungles of New Guinea. The emblem, reproduced in NPN last week is again reproduced here. The pledge is self explanatory. NPN has arranged with a Cleveland printer to furnish the Victory Emblems for the following prices: In lots of 500, $5.00; 1000 for $8.00; 5000 or over, $7.50 per thousand (*See page* 4.)



(Front View)



ERIE Submerged TURBINE PUMP

Goes THROUGH 4" OPENING

The Erie is unlike any other turbine type pumping unit—it is compactly designed to drop through a 4" opening—to pump petroleum products from storage under any conditions. It features freedom from vapor lock—it's sealed against tank vapor pressure—has water tight head—requires no priming—is self lubricated—equipped with Underwriters' approved motor of ball bearing explosion-proof type.

This pump is available for capacities from 25 to 75 G.P.M. for heads up to 175 feet and pressures from 10 to 35 P.S.I.

Write for complete data on this and the complete line of Erie Fueling Systems.

for

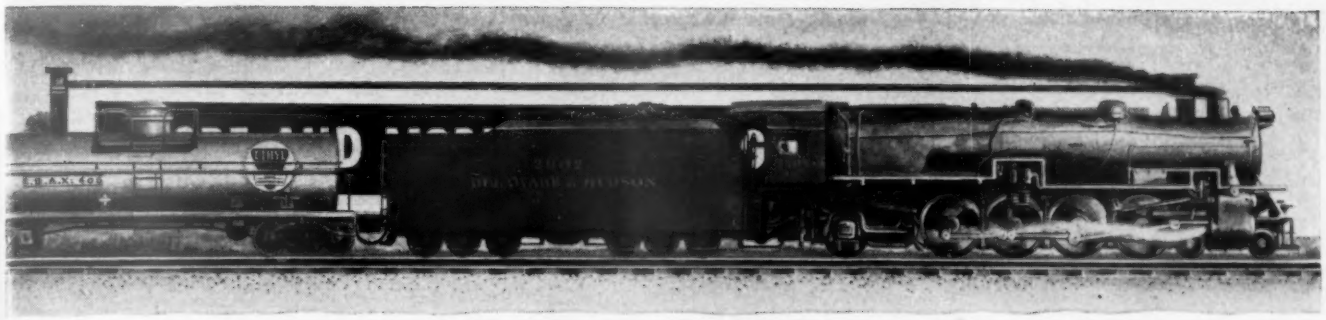
Air Ports
Cantonments
Fleet Terminals
Bulk Plants
Industrial

ERIE FUELING SYSTEMS
include the following:

1 *Gasoline-Dehydrators*
2 *Turbine, Centrifugal and Rotary Type Gasoline Pumps*
3 *Airport Fueling Pits*
4 *Truck Fill Stands*
5 *Tank Car Unloading Assemblies*
6 *Lubricating Oil Tanks and Pumps*
7 *Portable Lubricating Systems for Aviation Oil*
8 *Gasoline Driven Pumping Units with Air Eliminators and Meters*
9 *Valves and Fittings*
10 *Hose and Nozzles*
11 *Air Compressors*
12 *Air Meters*

ERIE

ERIE METER SYSTEMS, INC., ***Main Office and Plant: Erie, Pa.***



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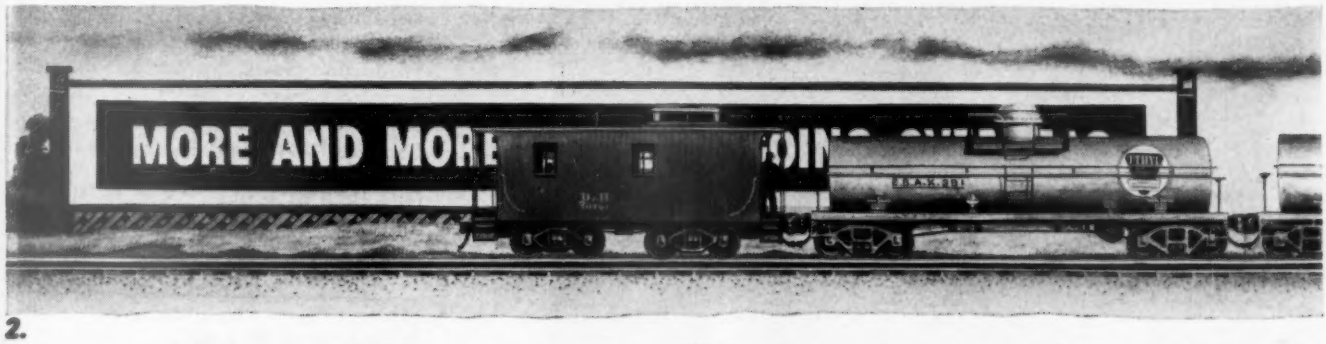

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Facts and Flashes

ETHYL IS A TRADE MARK NAME

Nearly a trainload of Ethyl fluid leaves for U.S. oil refineries every day . . . one reason why the American petroleum industry can supply our armed forces with tremendous quantities of the finest gasoline in the world.

Because military requirements today take the cream of U.S. gasoline production, octane quality of civilian gasoline has necessarily been lowered. Just as surely as Hitler and Tojo will go down, so gasoline quality at home will come up again. Fact is, you can expect to be selling far better gasoline than ever before. Ethyl Corporation, Chrysler Building, New York 17, N. Y.

Q. W. Regestein . . .

OPA's New 'Gas' Rationing Boss

THE HOTTEST POTATO in OPA—gasoline rationing—is now being juggled by Q. W. Regestein who has had 12 years experience in oil marketing with emphasis on service station operations. Except for the first year following his graduation from the University of Pittsburgh in 1930, he has been associated with Socony-Vacuum Oil Co.

His OPA experience dates back to January of this year. At that time, Col. Bryan Houston was searching the country for men from the industry who could aid him in the gasoline and fuel oil programs. Mr. Regestein was one of a quartet who offered to lend their services as consultants to the agency. When Charles Phillips succeeded Col. Houston as OPA boss of rationing, Mr. Regestein stepped into the job of Gasoline Rationing Branch Chief and has already proved himself a valuable advisor to the new rationing deputy.

"I thought gasoline rationing was tough from the industry side," remarks Mr. Regestein, "but I've found it's a whole lot worse sitting in the hot spot here in OPA." Although he expects the coming Washington summer to be warm in more ways than one, as far as he is concerned, he is busily "boning up" on the multitudinous problems that have resulted from wartime gasoline rationing. As soon as he knocks off for the day at the Census Building—home of OPA here—he tosses unfinished business into a brief case and gets at it at home during the evening hours. In this way, he manages to cram in more than a full-time job on gasoline rationing complexities and still spend the week-end with his family—Mrs. Regestein and son—in Rye, N. Y.

Although very talkative when it comes to discussing gasoline rationing problems, the new gasoline rationing chief is very modest regarding his rise from the ranks in Socony-Vacuum.

Completing a service station training course his first job with Socony-Vacuum was managing a service station for the company on Long Island. A year of this and he was ready for his first big job, supervisor of a number of stations on Long Island and this lasted until early 1935. After that came various important jobs with Socony-Vac.

New Wartime Edition Index

Black Gold Educating Youth	38
Coming Meetings	11
Criminals Eligible for Extra 'Gas'?	5
Drafting of Young Technicians	46
Editor's Page	15
Financial Reports	44
Gen'l. Peckham Reviews Oil Take	26
Key Officials in District 3	24
Markets	57
Oil Prices	58
Personals	63
Production News	38
Refining News	26
Statistics	56
Supplies for Victory—Parsons Text	18
Transportation News	31
Unnatural Barriers	31
War Oil Compliance	50
Washington News	6

BULLETIN

LINK 2D BOARD TO FRAUDS

CLEVELAND—The questioning of a former ODT official here this week emphasized the Cleveland rationing scandal by involving still another rationing board in a fraudulent deal in which police said 150,000 gals. of gasoline had been issued to a non-existent firm. The identity of the board was not disclosed.

Oil Supplies Were There!

As NPN went to press this week, first reports of the success of the long-awaited Allied invasion of the coast of France were coming in. Prime Minister Churchill told the House of Commons that 11,000 first-line airplanes were available for use as an air covering for the attacking forces.

He said that 4000 ships were being used to ferry men and equipment across the channel for the final drive to liberate Europe.

The oil industry of America has had a stupendous part in providing the oil and fuel for these thousands of airplanes and pieces of mobile equipment now playing such an important part in the storming of Hitler's defenses.

For months, as news released by the censors has recounted, vast quantities of lubricating oils and gasoline for planes and tanks have been accumulating in England. It is a great part of the 40 per cent of the industry's oil production that has been taken for military purposes.

Again, the oil industry hopes it can be said that "the gasoline and oil so vital to this tremendous task was available to our armed forces".

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NATIONAL PETROLEUM NEWS
NPN
NEWSMAGAZINE FOR OIL MANAGEMENT MEN

Press for Congress O. K. of Crude Boost

Thomas in Senate and Disney in the House Seek Increase by Amendments to Measure Extending the Price Control Act

By Herb Yocom
Chief, NPN Washington Bureau

WASHINGTON—One more final push for legislative action to increase crude prices was underway on Capitol Hill this week.

On the Senate side, Senator Thomas (Oklahoma) introduced an amendment to extension of the Price Control Act which would require setting of crude price ceilings no lower than the average national price prevailing in the 10-year period 1919-29, or $1.68 per bbl.

In the lower chamber, a group of House members headed by Rep. Disney (Oklahoma) prepared to fight through as an amendment to EPCA the so-called Disney bill which passed in the House last December.

In a letter to hundreds of members of the House, Rep. Disney and nine other legislators asked that they put their shoulders to the wheel "in this matter of a decent price formula for oil." Besides Disney, the letter was signed by Reps. Gossett (Texas), Harris (Arkansas), Gavin (Pennsylvania), Brooks (Louisiana), Rees (Kansas), Curtis (Nebraska), Rizley (Oklahoma), Elliott (California), and Vursell (Illinois). The full text of the letter follows:

"Enclosed is a copy of the Disney bill which passed the House overwhelmingly on Dec. 13, 1943. This bill is to be offered as an amendment to the current P. A. bill.

Asks Decent Formula

"OPA is ready to promulgate a vast subsidy program unless this amendment is adopted. All who voted for the original Disney bill and all who have opposed subsidies as a substitute for price increases should enthusiastically support this amendment.

"Please put your shoulder to the wheel in this matter of a decent price formula for oil. This amendment is sound in principle and has the support of a vast majority of both consumers and producers, and will be one of the most constructive pieces of legislation to be enacted at this session in support of both domestic and war programs.

"The Elk Hills bill indicates the absolute necessity for more oil. Thanks in advance for your good work in support of the amendment."

Also planned by this House crude price strategy group was a caucus of all interested House members for 10 a. m., June 7 to map out a concerted drive for adoption of the Disney bill as an amendment to the extension act on the House floor.

Chances for passage of the amendment in the House are good, considering that the Disney bill passed by an overwhelming majority last December. The odds are much lower in the Senate, however, as indicated by suppression of both the Disney and Thomas crude price bills by the Senate Banking and Currency Committee to which both were referred many months ago.

Meantime, no decision by Economic Stabilizer Vinson on OPA's stripper well subsidy proposal was immediately in sight, although one endorsing it has been expected momentarily since it was learned that PAW had reported its views on the plan a week ago.

Vinson's strategy may be to withhold action on the proposal until the Senate finishes action on the individual amendments to the Price Control Act recommended by the Banking and Currency Committee. His unveiling a stripper well subsidy program at the moment debate on an individual senator's amendments, such as Senator Thomas', on crude prices, gets underway, may well dampen the fire of some senatorial crude price increase proponents.

Succeeds Dodge

J. D. Collins, director and vice president in charge of sales for Tide Water Associated Oil Co. has been appointed to succeed H. W. Dodge, as Dist. 1 director in charge, it was announced this week by PAW. Mr. Collins has been associated with Tide Water for 20 years, starting as an accountant. He is also a member of Dist. 1 distribution and marketing committee, and formerly served on the old supplies and distribution committee. Mr. Collins officially took over his new post June 5.

Well Shooter Tax Upheld

Special to NPN

AUSTIN, Tex.—The Civil Appeals court has upheld the validity of the 2.2 per cent gross receipts tax on companies engaged solely in oil well shooting and acidizing.

PIWC Gets Optimistic Report on Materials

NPN News Bureau

WASHINGTON — The general material situation is now such, PAW Production Division reported this week to P.I.W.C.'s production committee, that PAW anticipates the program to drill a minimum of 24,000 wells this year will be met or even exceeded.

Disclosing that WPB has allotted 280,000 tons of carbon steel and 50,000 tons of alloy steel for third quarter production operations contemplating the drilling of 6,500 wells, PAW informed committee:

"Although actual completions failed to measure up to our programmed figure by some 4.4 per cent during the first quarter of this year, the general material situation is such that it is anticipated that the greatly increased number of drilling rigs in operation will make it possible to meet, or even exceed, our mmmum drilling program of 24,000 wells for the year."

Doubtful of Manpower

Other highlights of report included:

1. Nearly 1,500 rotary rigs were in operation during May, exceeding peak activity of past years by almost 200 rigs.

2. Crude stocks in District 5 continue to decline rapidly, amounting to 24,000,000 bbls. at end of April.

3. Upward trend in well completions begun in January "seems to have suffered a setback" in April, with completion of 20-odd wells less than in March, despite an increase in number of wells actively drilling from 2,803 at end of March to 3,019 at end of April.

4. Negotiations are under way for change in regulations whereby maximum material cost requiring specific authorization under PAW Form 30 for revision, construction or extension of field crude gathering line facilities will be increased from $5,000 to $10,000.

5. Even though recent changes in selective service laws affecting men over 26 have resulted in decreased activity in most local draft boards, PAW belief is that industry "should not be unduly optimistic over retention of men over 26 years of age until such time as the revised law has become uniformly operative."

6. Following investigation of various proposals for reduction in public lands royalty payments, PAW is presenting committee for study and recommenda-

(*Continued on p.* 11)

Midwesterners Cheer Plan To Honor 'A' Drivers; View Victory Emblem Blow at Black Market

NPN News Bureau

CLEVELAND—Wide and enthusiastic support of the "A" card Victory Emblem sponsored by NPN as a means of crushing black market practices and conserving the nation's fuel supply for war needs was indicated in early comment endorsing the proposal this week.

First industry reaction stemming chiefly from the Midwest, came from industry committees, heads of oil companies, and from officials associated with the marketing or production of petroleum products.

The emblem, featured on the cover of NPN last week, and again reproduced in the current issue, would honor the "A" card automobile driver for his sacrifice of gasoline in the interest of his country's urgent need for the prosecution of the war.

Many oil companies are either ordering, or have expressed intention of ordering, supplies of the emblems for distribution at their service station outlets.

Held Aid to Industry

In endorsing the plan, oil executives, generally, expressed the conviction that distribution of such an emblem among the 11,000,000 "A" card automobile drivers would greatly aid service station attendants in meeting what has been a difficult situation for them.

The emblem, itself, emphasizes the need for all drivers to conserve the nation's fuel supply, and expresses the patriotic willingness of the "A" card holder to sacrifice in the interest of the men who are fighting and dying on the far flung battle fronts of the world in order to bring America to triumph in the world conflict.

Midwest comment on the proposal follows:

Wesley Nunn, advertising manager, Standard of Indiana, and chairman, Dist. 2 Products Conservation Committee: "There's no question about it. The victory emblem will help hit at the black market anywhere. We suggest use of the emblem by oil companies interested in gasoline conservation. The idea fits in perfectly with the advertising and speaking program for conservation in Dist. 2."

W. J. Carthaus, general sales manager, Deep Rock Oil Corp. and chairman Dist. 2 Temporary Supply Subcommittee studying necessity for a supply directive: "It's good. It ties in with the tight supply situation. I don't think anybody wants a supply directive (similar to PAW 59 for Dist. 1) and anything we can do to get rid of the black market will help us stay away from such a directive."

Howard Swanson, Chicago division manager, Shell Oil Co.: "Service station operators are having a hard time staying honest because J. Q. Public apparently does not want them to be honest. The victory emblem with its patriotic appeal will ease that burden for station operators by encouraging use of rationed gasoline only."

G. C. Lilly, vice president Johnson Oil and Refining Co.: "We like it. Anything that keeps gasoline in the rationed channel is good. We'll buy the emblems and use them along with many others."

Brown Meece, sales manager, Globe Oil and Refining Co.: "It's a constructive idea. We have no retail outlets ourselves, but will certainly recommend to our jobbers that they obtain supplies of them for their service stations."

A. H. Eisler, secretary-treasurer, Trans-American Petroleum Corp.: "Outstanding idea. Calls attention what "A" card holder gives up. I think Platt's idea of withdrawing "C" cards from strikers is also an exceptionally good idea."

Drill Two New Shafts In Pennsylvania 'Wagon Wheel' Well

By Earl Lamm
NPN Staff Writer

FRANKLIN, Pa.—Venango Development Co. is now drilling horizontal "wagon wheel" wells Nos. 5 and 6 in its "oil mine" on the Grant property in Sugarcreek Township about two miles north of here.

The two holes are now 597 ft. and 615 ft. deep, respectively. Wells Nos. 3 and 4 have been completed to a distance of 725 ft. back into the oil sand, which is about as far as they can readily be drilled with the present rod pullers, although Wells Nos. 1 and 2 penetrated to a depth of 2500 ft., using lighter weight drill rods, which were worn out in operation.

A new rod puller has been designed and is nearly completed, and it is contemplated that all wells will be extended to the depth of the first two, then a vacuum applied.

At the present time there is no oil production from any of the wells except the small amount flowing with the drill water.

Delayed by Red Tape

Work is still being considerably delayed by red tape and difficulty in obtaining equipment under government priority regulations. Lack of a vacuum pump is holding up putting the four completed holes on production, although priorities for the vacuum pump and also a water pump for lifting surplus water from the 27 x 50 ft. work chamber at the bottom of the 430 ft. shaft have been obtained. However, the operators believe the two pumps will be available shortly.

The new rod puller is being made from salvaged scrap, as were the new heavier drill rods, which are 2⅜ in. O.D. with a half inch center hole allowing a freer flow of drill water. A 3⅞ in. rock bit is now being used instead of the diamond core bits which made the first two holes. Three crews are working eight hour tours, and it is anticipated that drilling will proceed much faster than heretofore, especially when the water pump arrives, as shutdowns are necessary at intervals while the drill pump lowers the accumulation of water in the shaft.

In addition to the 24 horizontal wells now being drilled in a circle approximately half way up the round 50 ft. high work chamber, portholes have been left in the concrete wall for drilling of two additional rings of 24 wells each, one ring being above the present ring of wells and near the top of the oil sand and the other below or near the bottom of the oil sand. Heat under pressure, either by air or steam, may be applied to the sand through the upper and lower rings of wells if at some time in the future that is found expedient. (*For operation details, see NPN July 7, 1943.*)

Elk Hills Contract Extended By Navy and Standard Oil

NPN News Bureau

WASHINGTON — The Navy Department and California Standard signed this week a 15-day extension of the present temporary contract governing operations in Elk Hills Naval Petroleum Reserve No. 1, which expired June 4.

By end of the 15 days the expectation is that Congress will have completed action on legislation authorizing the Navy and Standard to enter into a contract for unit operation of the field. The temporary contract was first entered into on Sept. 8, 1943, after original operating agreement between the Navy and the company had been declared invalid on grounds that no authority existed for such an arrangement.

$4,000,000 Pipeline Is Let To Bring Los Angeles Gas

NPN News Bureau

LOS ANGELES—Contracts for the installation of the first two sections of the new $4,000,000 pipeline project connecting the La Goleta dry gas field near Santa Barbara to Los Angeles have been awarded the Pacific Pipeline Construction Company, it was announced here this week.

This is one of largest pipeline construction projects undertaken in Southern California for many years and is designed to furnish additional natural gas for emergency peak day demands to customers in Southern California. Under terms of the contracts grading and clearing of rights of way will start within a month, and it is expected the job will be completed by November 15.

Local Board Cannot Deny 'Gas' Even for Illegal Purpose, District OPA Head Rules in Pa. Case

CLEVELAND—The Local Rationing Board at Athens, Pa., continued this week to puzzle over a difficult problem which not only questions the authority of all such boards to govern the rationing of petroleum products, but which may bring a breakdown in the general rationing system in that area.

The problem concerns a precedent established by arbitrary authority of a Williamsport, Pa., OPA district office which, on May 25, overruled the Athens board and granted 1200 gals. of fuel oil to Ray E. Cole, Athens trucker, for the purpose of constructing a private airport, which the local board had declared unnecessary. In denying Mr. Cole the fuel oil for the use of a tractor in constructing the airport, the Local Board pointed to adequate landing facilities at the nearby Valley Airport at Athens.

Even Criminals Eligible?

In overruling the Athens board the Williamsport OPA took the astounding position that the phrase "necessary purpose" has been interpreted to mean that the "ration issue must be necessary for the purpose for which it was issued". In this decision the OPA district office contended that it is not within the realm of the local board to determine if the occupational purpose for which the gasoline is issued is necessary. The district office then specifically stated that the gasoline must be issued even if the occupational purpose is illegal.

"An instance of this," said the decision, signed by Ray S. Thrall, district director at Williamsport at the time, "is that rations issued to persons known to operate in the numbers racket are issued because these people are eligible for non-preferred mileage even though the vehicle will be used by them in furthering their occupation which is contrary to state law."

This formal declaration elicited from the Sayre, Pa., *Evening Times* an editorial blast which pointed out indignantly that "Under the ruling of the Williamsport office, the Athens board would be compelled to supply gasoline for the 'getaway' car of a holdup man, if it were to receive such an application."

Pointing out that the decision goes so far as to "directly instruct the local board that it must issue gasoline to a criminal if he needs the gasoline for the pursuit of his criminal occupation," the *Sayre Evening Times* added:

"The Williamsport decision, if allowed to stand, will rob the entire rationing system of all sense and meaning and render the system inoperative. The Athens Board has not yet decided, as this is written, whether it will appeal from the Williamsport board's order. We submit that the Office of Price Administration itself should take action and make it unnecessary for the local board to further concern itself with the case."

Daniel J. Lucy, chairman of the Athens board, told NPN this week that the board is still undecided about the matter of carrying the decision to the Regional Board in New York City. Pointing out that the local body will have 30 days in which to take this action, Mr. Lucy said that members of the board are at variance on the issue. He added:

"But I thought the decision was terrible, particularly in view of the adverse publicity it gave our local board. It tore to pieces the 'necessary purpose clause' in the rationing order."

"An Insult to Members"

The *Sayre Evening Times*, in hearty agreement, pointed out that "The Williamsport decision is not only an insult to the members of the Athens board—men of high standing in the community who are taking their responsibilities seriously and endeavoring to do a patriotic job properly as unpaid volunteers—but to the public as a whole."

While the Cole case decision was signed by Mr. Thrall, it was issued coincidentally with announcement of the regional director of Mr. Thrall's resignation. Joseph L. Ray, district OPA rationing executive, has succeeded him.

Mr. Cole was understood to have declared his intention of starting work on his private airport early in June, following completion of another project under way at Athens. This project, carried out on oil rationed to him, was described by Mr. Lucy as "an exercising field for saddle horses".

Observers in the area contended that the OPA interpretation of "necessary purpose" would cover almost any vehicle so long as it required fuel for its operation, and that, therefore, the rationing of fuel oil and gasoline in that area has completely broken down.

The local board had based its decision denying Mr. Cole the fuel on the fuel oil regulation which states "the board must make the decision as to whether the particular use is for a necessary purpose. No ration shall be issued if the board finds that the request is not for a necessary purpose."

Still other observers pointed out that service men, returning from the battle fronts, are severely restricted in the use of gasoline and that in some cases they are permitted only five gals. for as long as 30 days.

Jersey Standard Honors Oldest Annuitant

William Kincade, 92, oldest living annuitant of the Standard Oil Co. of New Jersey, is shown here receiving a gold-banded cane and $100 from Ralph W. Gallagher, company president. The gift honored Mr. Kincade as the oldest annuitant on the company rolls. He has been with the company 66 years and was an employee 41 years

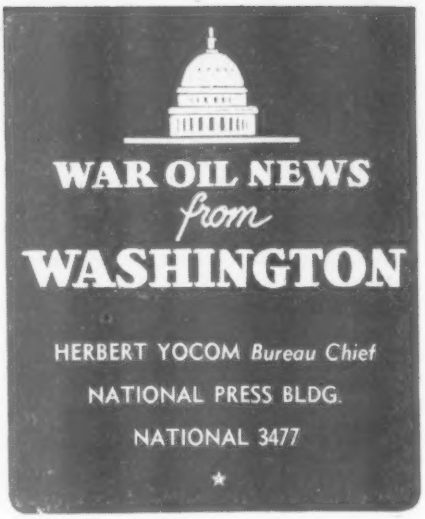
Nine New Yorkers Pay Penalty For Illegal Florida Trips

NEW YORK—Nine motorists, included in a group of 100 New Yorkers, were heard at regional OPA headquarters here June 1, on charge of illegally using their gasoline ration coupons to pleasure drive to Florida last winter.

All nine pleaded guilty, and all paid the price by surrendering their gasoline rations for periods of varying length. Coupons of four were revoked for duration of gasoline rationing.

A total of 1200 motorists face similar charges in the regional area.

House Votes To Double Lend-Lease Oil Exports; Petroleum Biggest Item in $7 Billion Bill



NPN News Bureau

WASHINGTON — The House gave speedy approval this week to a proposed 100% step-up in oil exportations under Lend-Lease, voting $1,121,811,480 for the purchase of 192,000,000 bbls. of petroleum products for overseas shipment during the fiscal year starting July 1.

Funds for the oil operation were included in a Foreign Economic Administration appropriation bill which makes a total of $7,188,893,000 available for Lend-Lease purposes in the new fiscal 12 months. Petroleum products constitute the largest single item in the huge money bill, which now moves to the Senate.

According to testimony given the house appropriation committee, the figure of 192,000,000 bbls. compares with present year's operation calling for lend-leasing of only 95,000,000 bbls.

Three-fourths Aviation 'Gas'

Also, it was emphasized that about one-half of the products lend-leased in the next period will be turned over for use of U. S. armed forces overseas, a fact which led the committee to comment that "on this basis, the use of Lend-Lease petroleum products by our Allies would account for less than 6% of U. S. production during the fiscal year 1945, far less than the proportion of prewar commercial exports to our production."

Of the 192,000,000 bbls. to be lend-leased, three-fourths or 144,000,000 bbls. will consist of aviation and motor gasoline.

Transcript of testimony taken by the committee in executive session was released with reporting of the bill to the House and disclosed for the first time some of the most intimate details of working of lend-lease operation as applied to oil. Highlights included:

1. Breakdown of proposed distribution of lend-lease oil shows $1,026,292,800 worth will go to the British Empire; $57,394,500 to Russia; $30,324,430 to China; $7,379,750 to French North Africa, and $420,000 to the Middle East.

2. According to a chart presented by FEA Administrator Leo Crowley, 2.9% of U. S. domestic oil production in the next fiscal year will be assigned under Lend-Lease for essential foreign use; 8.7% goes to United Nations armed forces and our own forces abroad, also under Lend-Lease; 0.9% is for cash export, and remainder, 87.5%, will be used in U. S. and for direct U. S. military export. The chart shows also that roughly 12% of U. S. crude will be used for making aviation gasoline; 30% for motor gasoline; 40% for gas, Diesel and fuel oils, and about 18% for all other products.

Reverse Lend-Lease Swells Total

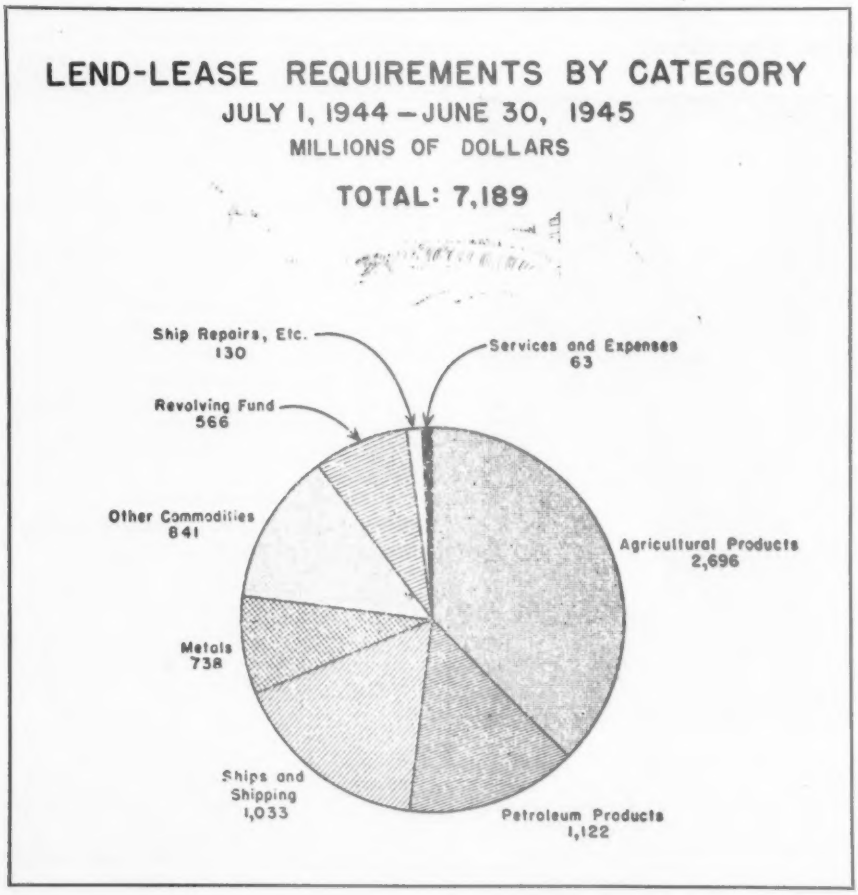
3. Not only do U. S. air, ground and naval forces share to the extent of about 50% in all products lend-leased abroad, but they also receive "additional large quantities" in the Mediterranean, Indian Ocean and South Pacific theaters under reverse Lend-Lease from British oil resources in the Middle East.

4. According to PAW Chief Counsel J. Howard Marshall, sum total of Lend-Lease oil requirements have been included in world-wide petroleum program for next year and PAW's forecast is that requirements can be met. Asked what effect this "enormous" demand would have on U. S. civilian requirements, Mr. Marshall replied that "under our present forecast we do not look for any substantial increase in the severity of civilian rationing. Of course, there are some areas perhaps where we will run into tight spots occasionally, but we have been able to go along about in the same way."

5. Products to be lend-leased to Russia include total of 3,600,000 bbls. of iso-octane, isopentane (both for blending up aviation gasoline), and various additive lubricating oil products such as paraflow and paratone. Total cost of these products is about $33,500,000 or average of about $9.30 per bbl.

6. Cost of operating the U. S. fleet in Lend-Lease service throughout the world under 192,000,000 bbl. program will amount to $383,880,000, a sum which is provided in the bill.

7. Petroleum products lend-leased to United Kingdom go into a petroleum pool along with products obtained by the U. K. from British sources in the Western Hemisphere. U. S. forces based in the U. K. are supplied from this pool. U. K. maintains a pool and bears storage, transportation and other handling charges without payment by U. S. forces. Records are kept of all deliveries of products to U. S. forces from the pool, and out-of-pocket British expenditures for hand-



ling products delivered to U. S. forces are carried as reverse Lend-Lease credit.

Explanation by Crowley

In his testimony before the Committee, Mr. Crowley said:

"Petroleum products for Lend-Lease countries are procured by the Foreign Economic Administration through the Navy Department. The Navy Department keeps detailed records of all Lend-Lease petroleum transactions and has inspectors at the points of delivery who verify the quantities and types of petroleum products turned over and obtain receipts from the recipient governments for these petroleum products. Lend-Lease petroleum products are generally delivered to the foreign governments at shipside at the port of lifting.

"Navy Department furnishes the Foreign Economic Administration with complete accounts for the deliveries of Lend-Lease petroleum products. On the basis of these accounts, the Foreign Economic Administration records Lend - Lease charges to the recipient governments for all deliveries of petroleum products. This record is kept for each country both by quantity and by dollar value. The charge to the recipient governments includes not only the cost of the petroleum products f.o.b. refinery, but also the transportation, storage, and other handling charges incurred by the Navy Department and met out of the Lend-Lease appropriation for petroleum products.

"The Lend-Lease petroleum products shipped to the United Kingdom, for example, are deposited by the British in a petroleum pool, which also includes products from British sources in the Western Hemisphere and a small amount from British local production. This petroleum pool is maintained by the British Government, which bears the storage, transportation, and other handling costs. The United States Army, the United States Army Air Forces, and, to a limited extent, the United States Navy draw petroleum products from the pool, as do the British armed forces.

"For each delivery of petroleum products to United States armed forces from the petroleum pool in the United Kingdom a receipt is issued by a United States officer to the representative of the foreign government making the delivery. Copies of the receipts are retained in the files of the United States armed forces involved. Foreign Economic Administration representatives in the United Kingdom check this basic record and copies of the records are forwarded from time to time to Washington, a copy going to the Foreign Economic Administration. It is the function of the Foreign Economic Administration to act as co-ordinator for reverse Lend-Lease, particularly in matters of policy and of operations concerning more than one Government department or concerning nonmilitary departments of the Government, and to make reverse lend-lease arrangements of an operational nature with foreign governments.

"Records of reverse Lend-Lease aid furnished to the Foreign Economic Administration by other Government departments and by foreign governments are reviewed and assembled for the purpose of reporting to Congress on over-all reverse lend-lease. Although these records are, of course, incomplete, it is our belief that the basic records in the field are kept as accurately as war conditions and the shortage of manpower in the areas concerned permit."

Aviation Fuel Topping Grade 130 Being Produced, Navy Reports; Pricing Methods Are Revealed

NPN News Bureau

WASHINGTON—The fact that through oil industry enterprise United Nations air forces are being supplied a more powerful aviation gasoline than grade 130 was revealed to the nation here this week.

The disclosure came from the House Appropriations Committee which made public a report containing a statement by the Navy Department Bureau of Supplies and Accounts, part of the committee testimony taken during hearings on the Lend-Lease Appropriation Bill. The Navy statement completely lifted the veil of secrecy which has prevented publication up to now of even the fact that air forces of the United Nations are being supplied with 130 grade.

The statement also revealed in full the method of pricing and prices paid for grade 130, including the fact that from July 1, 1943, through May 9, 1944, actual liftings of grade 130 at refineries for military and lend-lease use amounted to 26,107,949 bbls. This amount of product cost $166,036,776 or weighted average price per bbl. of $6.40. Scheduled liftings for the remainder of the present fiscal year (ending June 30), according to the statement, will increase this average to $6.42 per bbl., or 15.3 cents per gal.

Based on current price of $6.72 per bbl. at shipside, plus estimated transportation and other costs, average costs at shipside of grade 130 "or better" during the year starting July 1 is expected to be $7.70, a continuation of the upward trend which has seen the sale price to the military increase in less than 12 months from 14.5 to 16 cents per gal. due to necessary costly production methods.

More Powerful Fuel Being Made

The Navy statement revealed that an even more powerful fuel than grade 130 is in production in pointing to the possibility that still further increases in the cost of aviation gasoline are in the offing.

Following is the complete text of the Navy statement:

In developing figures for the fifth lend-lease appropriation, the cost at shipside of grade 130 aviation gasoline was estimated by the Bureau of Supplies and Accounts at $7.70 per bbl. of 42 gals. Before reviewing the factors upon which this estimate was made it is important to consider briefly the broad picture of aviation gasoline procurement. Grade 130 is strictly a munition of war used only by the military. If not the most important, it is one of the most vitally needed weapons of modern warfare. From the beginning of the war to the present time, United States production has not equaled requirements. This fact has compelled the utilization of every known means of producing the maximum quantity possible with all available facilities. It has resulted in many opera-

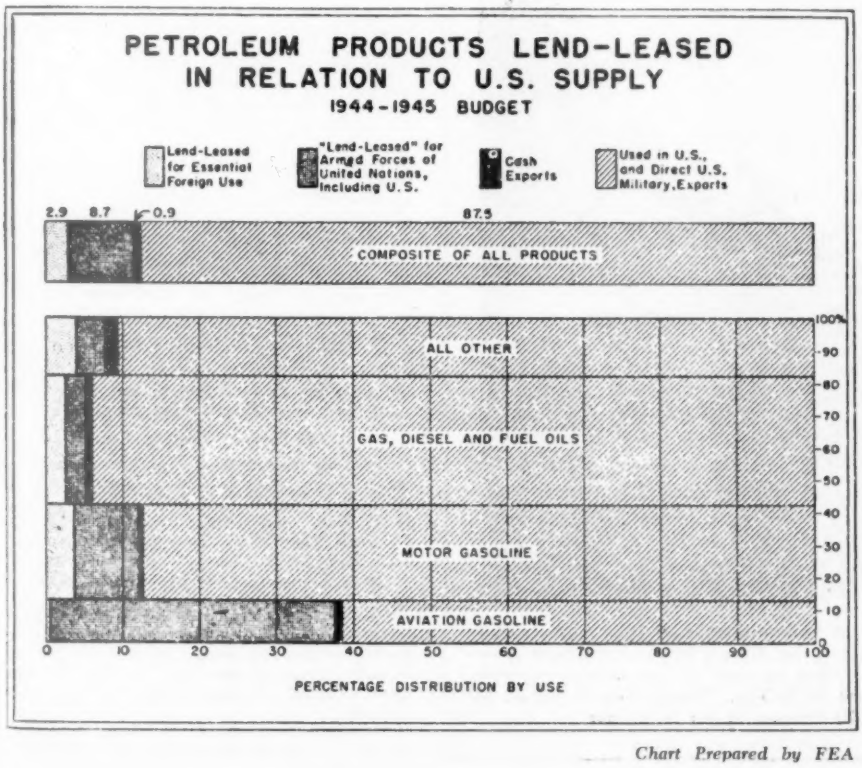


Chart Prepared by FEA

tions which are costly and which would not be profitable in commercial peacetime practice but which are essential to the prosecution of the war.

Why Prices Vary

To co-ordinate the program, contacts were made with all refiners for the purchase of their entire production by the Government through the Defense Supplies Corp. These contracts were made at so-called base prices for finished product at refinery and vary as between the several oil companies by reason of differences in operating methods, geographical locations, crude-oil sources, and other factors. At the same time, the War and Navy Departments agreed to reimburse refiners for excess costs incurred at the request of or with the approval of Petroleum Administration for War in its efforts to obtain maximum production and utilization of product. All of the gasoline purchased by the Government is then sold to the military through Defense Supplies Corp. at one price applicable anywhere in the United States. This sale price is fixed for each quarter by Petroleum Administration for War and is predicated upon the base prices paid the various refiners by Defense Supplies Corp. plus the excess costs previously incurred and approved, together with Defense Supplies Corp. out-of-pocket administrative expense not in excess of one two-hundredths cent per gallon. Theoretically, the receipts of Defense Supplies Corp. from sales to Army and Navy should equal disbursements to the oil companies for product at base prices and for excess costs and disbursements to itself for administration.

Obviously, no one can definitely forecast future prices for aviation gasoline with any greater degree of accuracy than one can foretell actual consumption, military requirements or improvements in the type of fuel or methods of production. Accordingly, in establishing $7.70 per barrel for the fiscal year of 1945, the Bureau took into consideration (1) actual experience during the fiscal year 1944, (2) actual costs today and (3) factors existing today which so far as can be seen will continue throughout the coming fiscal year.

For the year beginning July 1, 1943, the quarterly prices of grade 130 aviation gasoline for sales to the military for their use and for foreign governments under Lend-Lease were respectively 14.5, 15.25, 15, and 16 cents per gallon, or $6.09, $6.405, $6.30, and $6.72 per barrel. From July 1, 1943, through May 9, 1944, actual liftings amounted to 26,107,949 barrels at a cost of $166,036,776 or at a weighted average price per barrel of $6.40. Scheduled liftings for the remainder of the present fiscal year will increase this average to $6.42 per barrel or 15.3 cents per gallon.

Represents Cost at Refinery

This average of $6.42 per barrel, however, represents the cost at the producing refinery. To this must be added costs of transportation, storage, handling, and, in some instances, filling into containers. Refineries are well scattered over the country and even in those cases where plants are located at seaboard, tanker availability, turn-around time, and convoy movements do not always permit direct liftings. Based on the current price of $6.72 per barrel, plus estimated transportation and other costs, the average cost at shipside is expected to be $7.70 per barrel during the fiscal year 1945.

The trend of the sale price to the military has been definitely upward, increasing in less than 12 months from 14.5 to 16 cents per gallon. A large portion of this increase has been due to approved excess costs incurred in the constant endeavor to increase production. Upon the basis of excess-cost claims now under consideration by Petroleum Administration for War, the Bureau of Supplies and Accounts has been advised informally that the Defense Supplies Corp. sale price for the quarter beginning July 1, 1944, will not be less than 16 cents per gallon.

Before a lower sale price to the military can be realized, the refiners' so-called base prices to Defense Supplies Corp. or the amount of claims for excess costs, or both, must be reduced. It may well be that extended refinery operating experience and added production will result in slightly lower base prices for finished product at given refineries. On the other hand, increased production from facilities actually operating today tends to increase excess costs, particularly for the transportation of components, the development of more effective but more costly components and the squeezing of one more gallon from available material.

When production equals or exceeds requirements, a marked decrease may be expected in the excess costs included as a part of the sale price to the military because then and only then can the costly and unprofitable operations now in effect be eliminated. As previously mentioned, production today does not meet requirements. Anticipated increases in consumption may widen the present spread between production and requirements and delay the time when production and requirements are equalized.

Better Fuel To Cost More

Thus far, this discussion has been limited to grade 130. It is known that there is in production a more powerful fuel which exceeds grade 130 in performance results. While operating experience and the cost of producing this super fuel is extremely limited, it is known that the process involves the elimination of large quantities of the least expensive elements now used in refining grade 130, an increase in the quantities of the more expensive components, and the rearrangement of other existing refinery operations. The best available estimates indicate that the refinery costs of this new fuel will range from 6 to 10 cents per gallon more than grade 130. Upon the basis of the current Defense Supplies Corp. price, this will mean a per gallon cost at refinery ranging from 22 to 26 cents. To the extent that production of this new fuel is developed and increased, the cost for combatant aviation gasoline will likewise increase.

With the probability that the price of grade 130 will follow a line during the next fiscal year closely approximating the 16 cents per gal. level and with a reasonable expectation that there will be an increasing use of the newer and higher priced fuel, this Bureau firmly believes that the average shipside cost of aviation gasoline, grade 130 or better, will not be less than $7.70 per bbl. during the period in question.

Prices on 100 Octane Gasoline as Furnished by the Petroleum Administration for War

So-called 100-octane gasoline was first developed and produced in laboratories in the early 1930's and sold at prices which precluded its use other than for experimentation. From these early laboratory developments, commercial plants were built and the product was produced in small quantities and sold at very high prices, inasmuch as practically no market existed for the product and equipment and operating costs were extremely high in relation to the quantity produced. During this period, the petroleum materials used were byproducts of ordinary refinery operations, being available in fairly large quantities in comparison to the demand for this purpose, and the petroleum materials cost therefore, was a minor one.

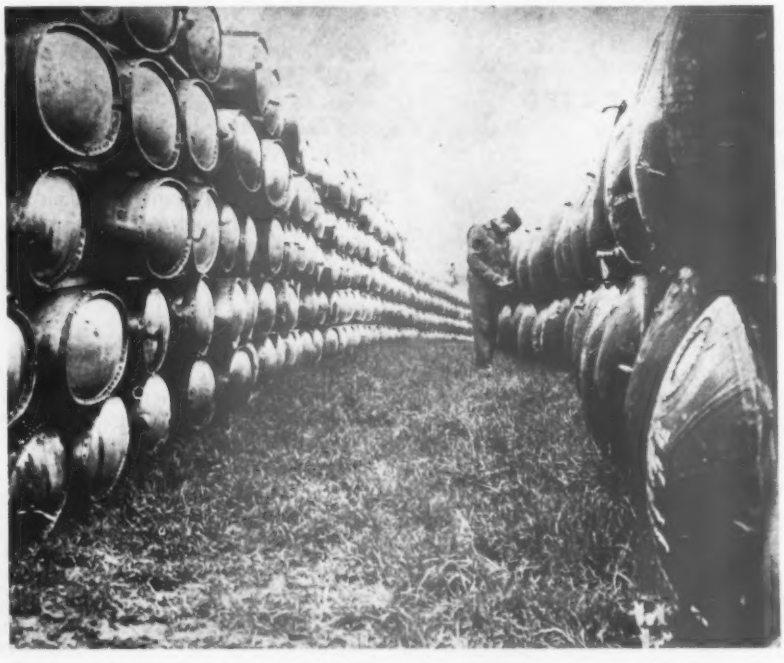
During the middle thirties, additional installations were made and 100-octane aviation gasoline was sold at prices around 35 cents per gal. at the refineries, but as demand for the product increased and the process improved, the price was gradually reduced. During the latter thirties, a new process of alkylation was introduced, and, being more efficient than the previous polymerization and hydrogenation processes, further reductions in prices were possible; and by the outbreak of the war the f.o.b. refinery prices on large sales, such as to the Army and Navy, had dropped to approximately 15.50 cents per gal.

"100-Octane" Generic Term

The only posted price for 100-octane aviation gasoline that has been located is that of the Standard Oil Co. of Ohio for the years 1940, 1941, and 1942, as reported by the *Oil Price Handbook*. The price quoted was 24.5 cents per gal. for Esso Ethyl 100 octane which is stated to be the Ohio state-wide consumers' tank wagon price. It is assumed, for comparative purposes, that if the same differential for freight and tank wagon deliveries applies to the 100-octane price as to that of regular motor gasoline, the netback at the refinery would be approximately 19.75 cents per gal.

At this point it should be made clear that the term "100 octance aviation gasoline" does

Self-Sealing Tanks Part of Invasion Supplies



Stacked high in long rows, this store of self-sealing fuel tanks for Flying Fortresses got a final checkup just before the Allied forces launched their invasion for the liberation of Europe. This is part of the great reservoir of supplies piled up by the Allies prior to D-Day. Sergt. Lee A. Jones of Dayton, Ohio, of the Army Air Forces, is the inspector

not refer to a specific grade of aviation fuel, but is a generic term applied to any fuel which is equal or superior to pure iso-octane. Prior to the outbreak of the present hostilities, a grade of aviation fuel had been furnished as 100-octane aviation gasoline, which met certain limited specifications and used three cubic centimeters of tetraethyl lead to meet the lean mixture 100-octane rating.

In order to expand production, one of the first changes made in the specifications was to permit the use of four cubic centimeters of tetraethyl lead per gal. resulting in the use of a slightly lower quality of components, which was followed very shortly by the addition of a rich mixture specification, which again increased the cost of manufacture. Since that time, there have been a number of changes in specifications, which have tended to improve the quality of the fuel so that the present grade 130 is far superior to the grade furnished immediately prior to the war.

With the outbreak of war in Europe in the fall of 1939, the demand for 100-octane aviation gasoline for export rose sharply and was given a tremendous impetus in 1940 and 1941 by reason of the need of our Government for this type of engine fuel. At this time it first became necessary to install equipment, the primary purpose of which was to produce materials from which 100-octane aviation gasoline is made, inasmuch as the expanded requirements were too great to be satisfied by the supplies of these materials available as byproducts in the normal refining operations. With this situation, the petroleum materials cost became a major factor in the cost of 100-octane aviation gasoline.

Previous Prices Listed

Records in the files of this agency disclose the prices at which certain specific quantities were sold to the Army, Navy, or Lend-Lease during the years 1940, 1941, and 1942. These prices vary somewhat for the period, location of plant and type of delivery, but they are for the same grade of gasoline except as noted and are representative of prices for the areas given. The range of these prices was as follows:

100-octane aviation gasoline (containing 3 cubic centimeters lead per gallon)

(Cents per gallon, f.o.b. plant)

Period	Atlantic Coast		Inland		Gulf Coast		Pacific Coast	
	Low	High	Low	High	Low	High	Low	High
1940	...	...	15.50	15.50	...	...	...	...
1941	...	...	12.50	15.50	14.355	15.75	13.00	15.50
1942*	13.95	14.81	13.75	14.50	12.925	13.961	13.40	13.75

*Last half, for aviation gasoline—100 octane, containing 4 cubic centimeters tetraethyl lead.

Because the Army and Navy lacked the authority to negotiate contracts for a period of three years, considered necessary to give the companies assurance of an outlet adequate to justify construction of new plants, it was decided that Defense Supplies Corp. would purchase the entire output of 100-octane aviation gasoline and would resell these purchases to the Army or the Navy or back to industry for sale to other qualified users as required. These contracts were negotiated by this agency and provided prices that assured the manufacture of his costs, plus a fair but moderate profit. The prices protected the high cost producer, while at the same time giving the Government the benefit of any low costs.

The range of prices paid to the refiner for 100-octane aviation gasoline by the Defense Supplies Corp. is shown by areas for January and December, 1943 in table below:

As noted above, there has been a gradual improvement in the quality of 100 octane aviation gasoline furnished by the petroleum industry during this period. This quality improvement has been obtained through the installation of new modern equipment and through the use of special high quality components. Where the increased quality is furnished by the installation of special equipment, the contract prices cover such increased quality, but where quality is made as a result of the use of high cost components, such as cumene, toluene, and xylene, the contract prices do not reflect the cost of these materials and the prices mentioned in the table, therefore, do not include the cost of such components.

During the early stages of the war, the estimated normal production of 100-octane aviation gasoline was far below the demand of the armed forces and it was desired to use every possible means of adding to the meager supply. High cost and uneconomic sources were called into operation for the manufacture of high cost components not only to improve quality but also to increase the over-all quantity available. To provide reimbursement for the added expense of this additional volume, the Army and Navy agreed with Defense Supplies Corp. that it would reimburse the companies for any losses incurred in such operations. These losses are paid by Defense Supplies Corp. and are passed on to the Army and the Navy and other users in the price at which the Defense Supplies Corp. resells its purchases. Not only has there been a continuation of the high cost operations undertaken in the early months of the war, but other uneconomic means have been found to further expand and improve the quality of the 100-octane aviation gasoline produced. At the request of the armed services, many refiners, installing new facilities, added additional hours to their work week, and paid bonuses for quick completion of these installations, which extra costs are also being paid by Defense Supplies Corp. and are included in the resale price at which Defense Supplies Corp. delivers this material.

Resale Price Increases

As a result of the conditions described above, while the base price of 100-octane aviation gasoline has gradually dropped during this period, the resale price of 100-octane gasoline has been increased because of the additional expense incurred in high-cost uneconomic operations and the costs incident to the rapid completion of new facilities.

The resale prices used by Defense Supplies Corp. since that agency started purchasing and reselling 100-octane aviation gasoline are set forth below, but in reading this table, it must be always kept in mind that into these resale prices have been added all of the extra construction and processing expenses that have been necessary to get the last possible drop of improved qualities of 100 octane in the shortest possible time. Thus, while the unit cost of 100 octane of the former specifications made in the normal way has been constantly falling, this trend has been obscured by the extraordinary expenses described above.

1943	Cents per gallon
First quarter	14.50
Second quarter	14.50
Third quarter	14.50
Fourth quarter	15.25
1944	
First quarter	15.00
Second quarter	16.00

It is anticipated that the contract price for normal production of 100-octane aviation gasoline will continue to drop below the figures shown for December, 1943, inasmuch as some of the largest of the low-cost producers and some of the lowest cost increments are only now coming into production. Furthermore, there are a number of small plants operating under a cost-plus-a-fixed-fee contract which are currently starting operation and are in a period of high-cost production. It is anticipated that the costs of these operations will be reduced materially. It is believed that there is no reason to expect any basic increase in the price of 100-octane aviation gasoline of a given contract grade unless there is some radical change in the cost of raw materials or in the case of a general inflation. The production of a different quality than that now produced would necessarily affect the price.

100-Octane Prices Defense Supplies Corporation

Period	Atlantic Coast		Inland		Gulf Coast		Pacific Coast	
	Low	High	Low	High	Low	High	Low	High
January, 1943	14.26	14.26	12.68	13.90	12.91	13.49	13.14	13.74
December, 1943	12.64	14.30	13.13	13.97	12.43	13.61	13.00	14.09

Billion-and-Half Road Bill Advancd in Congress

NPN News Bureau

WASHINGTON—Capitol Hill observers forecast enactment of H. R. bill 4915 authorizing $1,500,000,000 in federal road-building aid to states for the first three years after the war. The House roads committee unanimously approved this legislation on June 2.

The bill authorizes joint Federal-State designation of a new road system not exceeding 40,000 miles in length which will connect major population centers. It will be known as the National System of Inter-state highways. Half of the funds are to be apportioned among the states according to their populations, one fourth on the basis of area, and one fourth on post road mileage.

The bill provides that $150,000,000 annually be available for projects on federal aid highways within cities of more than 10,000 population. This is the first time in federal aid history that a definite sum has been earmarked for highways in metropolitan areas. The federal aid system, both in and outside cities receives $225,000,000 a year, and $125,000,000 will go to secondary roads in rural areas and in municipalities of less than 10,000 population.

The bill permits up to 60 per cent federal participation in projects authorized for the first postwar year, with a return thereafter to the traditional 50-50 matching principle.

Other provisions of the bill authorize continuance of the state highway planning surveys begun in 1936; a three-year program for highways in federal forests and national parks, with an authorization totaling $140,250,000 for this purpose. This latter program is all federal funds, with no state matching required.

L. V. Nicholas Quits OPA

NPN News Bureau

WASHINGTON—L. V. Nicholas has resigned as consultant to OPA's Automotive Supply Rationing Division, and has been succeeded by Harry Spears. Mr. Nicholas, former head of Warner-Quinlan Co., and well known Midwestern independent oil operator, joined OPA March 8, having been brought to the organization by Col. Bryan Houston, who resigned May 15 as deputy administrator in charge of rationing. Mr. Spears came to the organization at the same time.

Higher East Coast 'B' Ration Is Hanging Fire; Might Choke Off Black Market, Advocates Say

NPN News Bureau

WASHINGTON—Signals were on and then off again this week for higher "B" rations along the East Coast, but no one would say flatly that the situation might not be reversed again when OPA receives third quarter gasoline allocation figures from PAW in a few days.

Until last week it appeared inevitable that some increase in OPA's Dist. 1 "B" mileage ceiling would be made coincident with announcement of PAW's third quarter figures. This feeling was based on two important factors.

First, PAW, at OPA's request, was planning to lump together its allocations for Dists. 1, 2 and 3 in the figures it would make public for the third quarter. Obviously, this would have allowed OPA to make "adjustments" among the individual area figures received privately from PAW and thus effect a final and complete equalization in "B" ration values which now stand at 325 miles monthly in the East and 475 in the Midwest.

Secondly, preliminary April civilian gasoline consumption figures which were pouring in from ration banks throughout the country placed civilian consumption during that month at only 1,000,000 b/d, or thereabouts, compared with a PAW allocation of 1,257,000 b/d. Later figures, while increasing the civilian consumption figure, still showed a substantial under-consumption throughout the country—about 1,100,000 b/d, or approximately 150,000 b/d below PAW allocation.

According to the latest word, however, both of these factors are now out the window—for two reasons.

1. PAW has changed its mind, reportedly, and will, as heretofore, present a breakdown of individual district allocations when it publicly announces the third quarter figures.

2. OPA officials are said to have little confidence that April civilian consumption flowback figures represent anywhere near accurately the actual consumption during that month. They are now awaiting state tax return statistics, which they believe will show consumption very close to PAW allocations for the second quarter.

Cite "Rising Trend"

Aside from the validity or nonvalidity of flowback figures, OPA officials point out that even if consumption during April actually was well below PAW allocation figures, it could not be expected that this would continue throughout the entire second quarter period since consumption is on a rising trend during the three months April, May and June.

The reason for PAW's change of heart on public announcement of a single aggregate allocation for Dists. 1, 2 and 3 isn't hard to guess. There are not only a few eastern independents who would be extremely well pleased if Directive 59 were junked, but a couple or so major companies as well, industry sources say. Consequently, these sources add, it is easy to imagine the violent demands that would be made by these Directive 59 objectors if PAW, in its allocation for the third quarter, treated the three districts as one unit and thus, in effect, admitted that supply and transportation were flexible enough to obviate the need for treating the East, Midwest and Southwest as separate entities.

Entirely aside from the foregoing, however, there are some officials dealing with the problem who feel confident that an upward revision in East Coast "B" mileage ceilings would bring about very little, if any, increase in civilian consumption.

One of their main arguments runs about like this: Many people along the Eastern Seaboard who must drive cars in the course of their work, such as salesmen of important, if not "essential" civilian products, are limited to an impossibly low ceiling of 325 miles monthly. Under such a stringent ceiling, and faced with the absolute need of getting more gasoline some way if they are to continue working, many of these "B" card holders have turned to the black market for extra gasoline supplies. If they were granted more gasoline, or made eligible for a greater monthly mileage, say six or seven hundred miles, they would quickly turn to legitimate purchase of gasoline which in turn would have a noticeable reducing effect on the market for black market gasoline.

The very same argument was used this week by the American Automobile Assn. in demanding "immediate action" by the various government agencies to adjust what it termed serious inequities in gasoline rations. The A.A.A. said that there was an apparent surplus supply of gasoline available at the retail level which, "instead of being rationed by government agencies on the basis of need, is being sold to the public at high prices through the black market."

It now looks as if the next move depends on whether PAW presents its third quarter allocation figures to OPA in consolidated form and whether the rationing agency can tear itself loose from contradictory statistics long enough to give serious consideration to the possibility that higher "B" rations in the East will mean a reduction in black market operations and no over-all increase in consumption.

OPA Set To Peg Residual Price at 13-15.9 Level; Letters Sent to Districts; Action Due Soon

NPN News Bureau

WASHINGTON — OPA's plan to peg residual prices at the level now obtaining for 13-15.9 gravity and wipe out differential prices below and above that bracket is contained in letters which went out this week to industry committees set up by the price agency several weeks ago in Dists. 1, 2, 3 and 4.

The action is the result of conferences held with committee members from each of the four districts a few days ago, and it is expected that the new residual pricing method will go into effect in the near future.

Briefly, the background on the residual price problem runs about as follows:

About a year ago, OPA set up a gravity scale residual pricing method with separate price areas throughout the U. S. except in Dist. 5, and established for each area a base price for 9.9 gravity and below which reflected the approximate average price ceiling for refiners in the same area for No. 6 fuel oil.

Less Heat, but Higher

Then, on top of this base price, were added price differentials for five gravity brackets above 9.9, with ceiling prices progressively increased for each of the higher brackets. Objective was to provide an incentive for refiners to blend more valuable distillates with No. 6 fuel oil and thus increase the supply of heavier oils, which at the time were in a very short position, particularly along the East Coast.

Main peculiarity with this pricing method, from a marketing standpoint, was the fact that, while the blends in the higher gravity brackets carried a higher ceiling price, they were less desirable to such consumers as railroads and factories because they contained fewer B.T.U.'s (British thermal units) per gallon.

This factor, at the time, was unimportant as far as putting marketers of the lighter blends at a competitive disadvantage, since supply was so short that consumers were willing to take whatever was offered.

During recent months, however, the supply trend has been almost completely reversed, so that now residual is in a long position while distillate production has steadily dropped. As a result, marketers able to obtain only the lighter residual blends have been placed in a decidedly unfavorable competitive position.

Although the problem of stimulating distillate production while still preserving a sufficiency of residual has been an important factor in discussions leading toward price revisions, this has been more in the bailiwick of PAW from a supply standpoint. OPA's main objective, on the other hand, has been to revise the residual gravity scale pricing arrangement so that marketing of light-

er blends would not be placed in a prohibitive competitive position.

When the question finally came up as to whether the gravity scale on residual prices should be eliminated, first problem was to determine what price should be established for No. 6 fuel oil if one flat price were adopted. Conceivably, OPA could have returned to the old base period price on No. 6, but it felt that, in order to properly supply military and war industry demands, a greater supply of residual would be needed than was being refined in the base period and that these demands would still require some blending with lighter distillates.

Therefore, in order to meet these essential demands, OPA wanted to provide a price at which the price agency could expect industry to supply essential needs without complaining that the price was too low to permit blending in lighter ends.

13-15.9 Made Pacemaker

OPA's answer was to adopt the ceiling now obtaining in the 13-15.9 gravity bracket as a flat price for No. 6 and in doing so, the price agency emphasizes these two things:

1. OPA does not believe that there will be any increase in the fuel oil consumer's bill, on the average, since some have been burning low gravity blends and others, higher, more expensive gravities. On the basis of present information, the flat price proposal will reflect the average price which consumers have been paying for residual and blends.

2. OPA has tried to make it clear to the industry that the flat price contemplated is sufficiently high to provide all of the residual needed, while not presenting any basis for complaint that production will be hampered. The price proposal provides a price cushion which is "soft" enough so that refiners can be expected to supply whatever amounts PAW may request.

In essence, OPA feels that neither the industry nor the consumer should have any complaint with the flat price proposal since the consumer will pay, on the average, just about the same he has been paying, while the industry will be provided a better No. 6 price than obtained during the base period.

At the OPA-industry committee meeting there was also considerable discussion regarding prices for No. 5 fuel oil and Navy grade special. In general, the present OPA proposal provides, on the first point, that the industry use either the No. 6 maximum price or the old base period price for No. 5, whichever is higher. The price agency was not in accord with the recommendation of some industry members that the same price differential which obtained during the base period between No. 5 and No. 6 be preserved under the new arrangement, feeling that it had the choice of only two alternatives: (1) To return to base period prices altogether, or (2) to set up a higher price for No. 6 and leave the No. 5 ceiling unchanged.

However, OPA has provided in its proposed method of residual pricing that in the case of a "special" grade of fuel oil, such as navy grade special, the seller can take either the No. 6 ceiling price or a price approved by OPA upon application by the refiner. In this way, it is pointed out, the door is still open for consideration of a higher price for such special oils; OPA will treat fuel oil price for special grades on an individual basis, taking into account the different conditions and circumstances involved. Only exception to this rule will be in price area "E"—the Gulf Coast. For this area, OPA has spelled out a specific price of $1.05 per bbl. for such special oils. This would be an increase of 8 cents per bbl. over the proposed No. 6 flat price of 97 cents per bbl. Other areas, as noted above, will be handled on an individual refinery basis, if the refiner chooses to apply to OPA for a higher price than the ceiling for No. 6.

GETS OPTIMISTIC REPORT

(*Continued from p. 3*)

tion a plan involving a dry hole money contributory feature. Plan, which was suggested to PAW and which would require congressional action, would provide for royalty payment of 12.50% for ten years from date of discovery for all leases in all new pools where the operators have made contributions to drilling of discovery well.

7. Number of geophysical and core-drill units active in April was 436, five less than in March. The states of Mississippi, Alabama, Georgia and Florida accounted for 21.1 per cent of total geophysical activity in U. S. during April.

8. Exploratory well completions in April totaled 302, increase of 9 over March. On cumulative basis, the 1115 completions for first four months of 1944 show increase of 14 per cent over 974 completions in corresponding 1943 period.

9. Although discovery rate of exploratory wells thus far is "quite favorable," being 20.2% successful and much better than 15.8% rate during all of 1943, amount of reserves represented by discoveries appears comparatively small. Percent of successful exploratory completions declined in April. Of 55 discoveries made, 39 were oil and 15 were gas, and of oil discoveries, 24 were in new fields and 15 new pools in old fields. Ratio of gas discoveries was higher than normal.

Editorial

Industry Honors Army's Efficient Oil Division

AND NOW for some kind words.

Not all war agencies are bad and some that have been bad get better and even good. This last is true of the Army's Fuel and Lubricants Division. It is so good today that a group of oil men, who have had to deal with it, called a meeting of the F. & L. Division and Washington's oil celebrities and said kind words and gave a token to Gen. H. L. Peckham the head of the Division and his staff consisting mostly of technical men from the oil industry. (*Story, p. 26*).

The oil men who got up the testimonial party are the lubricating experts from the oil companies who have had to struggle with the Army and Navy's oil supply problem since the start of the war. They are the men who found themselves almost hopelessly handicapped by past incompetence of government and they are the men who have worked with the new personnel in this division since its establishment on its present basis a year ago. They are the men who know how well it is doing the job.

So these oil lubricating experts, on behalf of the oil industry and with the official benediction and presence of PAW Deputy Davies, and Assistant to the chairman, Hand, of PIWC, last week told Gen. Peckham and his staff how well they have done and how much the industry appreciates that kind of a job. To their good words of approbation, NPN wants to add its own for our Washington Editorial Bureau has heard nothing but praise for the fairness and efficiency of Gen. Peckham and his staff.

Would that all war agencies deserved similar praise!

Coming Meetings

JUNE

American Petroleum Institute, Southwestern District, spring meeting, Rice Hotel, Houston, Tex., Tues.-Wed., June 13-14.

Pennsylvania Grade Crude Oil Assn., annual meeting, William Penn Hotel, Pittsburgh, Pa., June 16.

Kentucky Oil and Gas Assn., midyear meeting, Lexington, Ky., June 24.

American Society of Testing Materials, annual meeting, Waldorf-Astoria Hotel, New York, June 26-30.

The National Council of Independent Petroleum Associations, monthly meeting, Netherland Plaza Hotel, Cincinnati, June 27-28.

Interstate Oil Compact Commission, quarterly meeting, Shirley-Savoy Hotel, June 30-July 1.

PIPELINES—*Views of the Industry's Problems a*

Washington— *Weakened PAW Worries Oil Men—It Might Refuse To Die* —By Herbert Yocom

WASHINGTON—If there is one thing the oil industry wants above anything else it is the assurance that the end of the war will also mean the end of PAW and of government regulation.

Mr. Yocom

This being so, it seems to this writer that the recent and continuing exodus of top-flight officials from PAW ought to be a matter of real concern to the industry for the obvious reason that unless PAW can replace these individuals with men of comparable stature then PAW is in a fair way of becoming just another government agency, staffed and led by petty bureaucrats whose main interest in life is their own perpetuation in public office.

The danger here is real, not imagined. It has happened before in government and it CAN happen again, which is why we think that industry ought to respond to the call that most certainly will come from Deputy PAW Davies and see to it that he gets the calibre of replacements he thinks PAW is entitled to if the war-oil job is to continue to be well run.

No one needs, of course, to be reminded that PAW is the one agency in government today staffed almost 100 per cent by men from the industry for whose war operation it is responsible.

As everyone knows, too, Mr. Davies insisted from the beginning that it be that way, arguing that the best guarantee of PAW's ultimate dissolution was to man it with industry experts whose sole objective would be getting the war-oil job done and over with in the quickest possible time. In other words, he envisioned PAW as a self-liquidating agency, one which would fold almost automatically with the end of the war because of the incentive to return to better-paying jobs in industry.

That arrangement or plan of operation has up to now, at least, been to the evident satisfaction of the industry. At any rate the industry has been wont to boast of the great accomplishments of this unprecedented government-industry team which fueled this week's invasion landings in Europe.

In the face of this fact, it is rather surprising to find in industry today an apparently growing attitude that the game is pretty well won and can be played from here on out by the second string. That, we submit, is dangerous thinking. It is thinking of the type that can and may lead to loss of the very thing which industry wants most to win —the opportunity, once the war is over, of returning to a free, competitive status in the speediest possible time.

Atlantic Coast— *Streamlined Distribution Will Save Jobbers Postwar* —By John D. Meyer

NPN's guest columnist this week is John D. Meyer, secretary of EPIC and assistant to the president of the Southeastern Oil Co., Mr. Meyer gives his impressions of the changes that are taking place and which will continue in gasoline distribution.

NEW YORK — No one can accurately foresee the exact pattern of gasoline distribution that will take shape when refinery operations and transportation are relieved of war requirements. Nevertheless, there are certain known facts and rather well established trends which indicate a rather severe departure from the ways of distribution as we knew them early in 1941. Although certain changes are inevitable through the normal evolution of ideas and will be felt by all segments of the industry, there is deemed to be a more pronounced metamorphosis along the Atlantic Coast which will be felt to a greater degree by gasoline jobbers and distributors.

Mr. Meyer

It is no secret that many large marketers are now laying plans for a more direct form of distribution which would eliminate certain steps in the present chain of distribution. These plans include such ideas as: (1) Direct company operation from pipeline or ocean terminal to the retail service station; (2) direct company distribution to retail stations in concentrated urban areas, with some retail stations equipped with sufficient storage capacity to serve as a supply point for pedlars who would deliver to less populated and rural areas; (3) the creation by large marketers of 49-51 per cent co-ownership jobbing companies to operate in a whole state or large portion of one. There may be several variations of these plans; however, the net effect is to leave both the branded and unbranded jobber in a vague position.

Even now, several large marketers, who have been accustomed to distribute the bulk of their gasoline through small local jobbers, have representatives in this field endeavoring to buy out these jobbers and their retail and wholesale business, so that only a small volume of total distribution will be lost in the switch-over to direct company operations. Other large marketers who normally distribute through commission agents or distributors have exercised the 10-day notice provision of such contracts where the particular location is a logical one as a terminal point for direct distribution to areas now served by as many as 50 other smaller commission agents.

To a certain extent, therefore, the small, local gasoline distributor, be he commission agent, distributor or jobber, is faced with the problem of continued independent existence. He will be bought out, checked or cancelled out, or offered employment by his former supplier as territorial representative with his remuneration reduced to a small salary or a fraction of previous commission or margin, UNLESS he is realistic.

It is unfortunate that large marketers are taking advantage of short and insecure supplies to start putting their plan into effect. But a courageous jobber does not have to sell out. He can hold out pending the development of new sources of supply after the war. Government regulations protect his present source of supply. It is true that he may not be able, postwar, to secure gasoline from his present supplier, but in some cases he may be able to persuade a large branded marketer to give him a territory franchise for direct operation from the marketer's terminal points, thus eliminating the bulk plant. In such a deal, however, the jobber could not expect the 2 cents or 2.50 cents margin but would be forced to the level, more consistent with costs of direct company operation, of 1 cent to 1.50 cents per gal.

On the contrary, his greatest opportunity is to secure supplies from independent sources provided certain facts are taken into consideration. (1) Immediately after the war there will be very few independent refineries equipped with facilities to compete with the larger refineries of integrated companies. (2) Whereas in 1941 the average tanker capacity was approximately 80,000 barrels, by virtue of the war need great numbers of 135,000 barrel tankers have

been constructed and for the most part sold to large oil companies who have traded in their old smaller vessels.

Postwar, the large marketers will own a going-fleet of 135,000-barrel tankers which will reduce their tanker rate to a lower unit cost. (3) The large integrated marketers own or control all of the existing pipelines and will in all probability acquire by purchase from the government all those pipelines such as the Big Inch and the Little Inch which are built under the pressure of war requirements. (4) All large marketers own, or control by lease, large deep-water terminals along the Atlantic Coast where their new tanker fleet will discharge cargoes.

Taking into consideration these four factors, it is logical to assume that up to the terminal point distribution is intended to be as efficient and cheap as it can possibly be. But, from the terminal to the consumer distribution would continue to be inefficient, wasteful and costly if old methods were used. Therefore, by applying streamlined direct distribution the larger marketers intend to provide efficient and cheap distribution all the way from refinery to consumer, *ultimately reducing the cost of gasoline to John Q. Public.* Jobbers will have no justifiable complaint against lower consumer cost, but to survive must do these three things: (1) Establish closer relations with independent refiners located on tidewater to see to it that these refiners improve their facilities so as to manufacture the same quality material and the same quantity from a barrel of crude as do the large refiners; jobbers should organize in groups for the purpose of assisting independent refiners and guaranteeing them a market, even to the point of investing capital in refinery improvements and in crude sources. It is not improbable that such a group could buy or build a refinery for their own use; (2) jobbers should organize to construct, or arrange through existing independent facilities, terminals at strategic points along the Atlantic coast; (3) jobbers should, through co-operative action, secure as soon as possible enough new and modern tankers to provide them with competitive transportation for the material to be moved from independent or jobber-owned refineries to independent or jobber-owned terminals.

The failure of the East Coast jobber to establish any one of the above three arrangements will at the end of the war or shortly thereafter leave him at the mercy of the larger supplier and in most cases cause him to be forced out of business.

Jobbers awaken! *Plan for streamlined distribution!*

Midwest— *Co-ops Hard Put to Explain Tax-Free Status* —By Earl Lamm

SOUTH BEND, Ind.—The co-operative situation appears more complicated the longer you look at it, because the co-ops themselves are having a difficult time explaining why they pay no heavy income taxes such as other businesses pay.

Mr. Lamm

Co-operative League News Service, official spokesman for the co-ops, has challenged statements made by Fulton Lewis, Jr., radio commentator and columnist, on May 13-14, by denying that salaries of co-op officials are limited to $7500 a year. Only limit on both salaries and expense accounts of co-op officials, C.L.N.S. said, is that imposed by the co-op board of directors; that is, there is no legal limit in laws governing co-ops.

On the question of tax payments, the co-op news service declares co-ops pay the same income and other taxes as are paid by ordinary business. The statement is a charitable view, which seems to make the printing of several pages in Internal Revenue Department's Regulation III exempting co-ops from income taxes, a waste of paper at a time when the whole country is looking for paper scrap. The regulations were quoted in NPN's recent story on the activities of the National Tax Equality Assn., which was organized for the specific purpose of calling tax inequality to the attention of business and the public and securing legislation putting all business on an equal footing. (*See NPN, May* 3, *p.* 18)

In vowing that co-ops pay the same taxes as other businesses, the co-op news services states: "The savings which co-operatives return to their members or which the members democratically vote to invest in capital is not income and therefore not subject to income taxes. This is the same right which is available to other business which may return overcharges to their customers if they wish."

It appears from this that ordinary business has been mixed up in its bookkeeping phraseology for a long time, for in highly competitive business, stockholders are urged to buy products made by their own companies and usually do but when "overcharges" are returned to them, the slip of paper is marked "dividend check".

We are of the opinion that what the co-op news service would have to say in telling the whole truth is that co-ops have the privilege of paying the same income tax as ordinary business, but obviously do not exercise that privilege or they would have so stated. To clarify that comment, co-ops pay income tax on profits left over after "returning overcharges to customer" or after "democratically" voting to invest in more co-op capital—put their earnings back into the business. Joker is that there's no money left over on which to pay income tax.

Another advantage co-ops have over ordinary business, is that their securities are exempt from regulation by Securities Exchange Commission. When they want to issue new stock, it is not necessary to get SEC approval. The exemption was originally set up under Section 103 of the Revenue Act of 1932, which now appears as Section 101.

Incidentally, two midwestern co-ops recently put on stock selling campaigns. They are the Ohio Farm Bureau (Farm Bureau Co-operative Assn., Inc., Columbus) and Consumers Co-operative Assn. of North Kansas City. Prospectus of the Kansas City co-op has received a great deal of unusual circulation. It was photostated by a large independent oil company and widely distributed to other oil companies in order to show the unfairness of present tax assessments against regular commercial businesses while competing with tax free co-ops.

There are, of course, two ways in which to equalize taxes. One is to require co-ops to pay the same taxes as regular business and the other is to exempt regular business from taxation in the same manner as the co-ops are exempt.

New Manager Will Take Over McPherson Co-op Refinery

NORTH KANSAS CITY, Kans.—Walter R. Graham has been made general manager of the McPherson, Kans., refinery of the National Cooperative Refinery Assn., Howard A. Cowden, president of N.C.R.A., has announced.

Mr. Graham with an engineering, business and automotive industry experience of many years, has been in the cooperative field since 1935.

On June 15 he will assume his new duties, succeeding A. E. Landstittel, who has resigned because of ill health.

The McPherson, Kans. plant, a 17,500 b/d refinery, was formerly owned by Globe Oil and Refining Co.

OUR BEST-DRESSED MEN WEAR NO HOSE THIS YEAR!

The Chemical Warfare Service of the Army has provided this style note. ★ To lighten the load of paratroops, armored forces, assault infantry and amphibious troops, the Chemical Warfare Service has developed a streamlined gas mask which does away with the hose by attaching the canister directly to the facepiece.

It's a design that results in a gas mask lighter to carry, more comfortable to wear... and gives the soldier greater freedom of action. Crown Can is making the canisters for this new model... just as Crown Can made them for the older types.

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Democracy, as Oil Men Now Practice It, Calls For Full Representation of All Groups!

DIST. 1 DIRECTOR DODGE, himself a major company oil man, almost by way of valedictory, for he has returned to his old company, earnestly advised the district's new distribution and marketing committee at its first meeting the other week, to act at once to remedy one of the greatest evils in the relationship of major oil companies to their smaller competitors.

He told his committee members that they should see to it that, at all times, their committee and all related committees, fairly and fully represented ALL the elements of the entire distributing and marketing of petroleum. Otherwise, he pointed out, decisions might fall so far short of truly representing the industry that they would be ineffectual.

To the time-honored retort that "large" committees could not work, Director Dodge said he could see no objection to large committees where they represented the necessary units in an industry; that there is no merit in a small committee just because of smallness if it did not sufficiently represent the people involved in the problems.

When Mr. Dodge took charge of Dist. 1 he at once went to work for more representative committees. He also made many contacts outside of the regular PAW committees in order to get the thinking of the industry and to hear the expression of all elements in it.

While few of the industry committees in our war set-up have been as comprehensive as they should be or as frank and cooperative with the others in the industry as is desirable, Dist. 1's committees were no exception in lacking full representation of the Independents and also in being unnecessarily and unwisely secretive in what they were up to.

Major oil company executives so often have been too prone to think within the industry in terms of gallons rather than in terms of people and of political votes. The result naturally, has been insufficient representation of the independents on so many industry activities even though in point of numbers they are in an overwhelming majority, while in terms of service station gallonage they are close to a majority though in terms of refinery output they are, of course, a small minority of but 15%.

For some strange reason also, many major company executives, have refused to give heed to oil industry history in diagnosing where their troubles come from. These oil men seem to think that their troubles all come from "the public" and the "politicians" and if the companies could but tell "their side" to the people their troubles would end.

If these executives would but look over oil industry history, back even to the beginning, they would find that practically without a single exception every bit of what they call "trouble" actually originated from within the oil industry and for competitive reasons. Perhaps a state legislature or some public official did the speaking against the major oil companies but the legislature or public official was stirred by those within the industry who felt they were being put to an unfair disadvantage by the larger companies that were attacked. This is true right down to the present time.

Unfortunately, too many times there has been some ground, at least, for the complaints, regardless of what was to be said on the other side of the argument. Public relations advertising campaigns to the general public, no matter how grand they may look, are useless as long as some competitors have an alleged or seeming injustice to tell the authorities, and do a good job of telling it.

When the industry created its war organizations it repeated largely the great mistake it made during the code days and which led to the Madison case. That mistake was insufficient representation in the important committees and conferences of the industry of all of the important groups of Independents. As if to make sure of "rubbing it in" many war committees erected an almost impregnable and utterly foolish wall of secrecy, just as they did in the late code days. But, unlike under the code, the major oil men this time had only themselves to blame. In the code days, the oil men also were partly at least to blame. The secrecy was first ordered, most emphatically, by none other than that great exponent of pitiless publicity for the "common people," Secretary Ickes. Instead of rebelling at his utterly unAmerican order, many oil men simply saluted and began the march that led to Madison.

When Director Dodge took charge on the East Coast he found irate Independents who were strongly suspicious of PAW and all other government agencies because they undertook to work in secrecy and without fair representation from the minorities of great industries. The Independents had but limited, if any, representation on the important oil committees and were told exactly nothing of what these committees were considering doing to the Independents' own businesses until the official orders came out or until NPN broke through the veil of secrecy and, in defiance of committee wishes, printed the facts. This, by the way, NPN always has done and always will do with respect to information that belongs to the Industry and which is not of military value.

NPN has been asked from time to time, by first one side and then the other, to take an editorial position as to the details of East Coast orders. In other words, to judge the merits of all contentions. But the problems of the East Coast have not been as simple as that, the line between right and wrong, or what is best to do and what should not be done, has not always been clear, by any means. Good Independents have been divided as have the majors.

The questions have been such as can only be settled by discussion and decision by all those interested. Given full and fair discussion before committees that truly represented all parties, there seemed no reason why a fair decision could not be made. And that is what NPN has fought for, not only on the East Coast but at Washington and all over the country. As to the East Coast, NPN believes that it has had some slight influence in bringing about more representative committees, fairer hearings and more Independents in the government's own program. But, unfortunately, it is always difficult to get early positions changed.

What so many oil men, and other industry men as well, have not recognized in this practicing of democracy through industry and government committees, is that there is seldom in business practices a sharp line dividing what is right and what is wrong, such as we all accept without question in the Ten Commandments. In considering business practices and customs, the questions are rather what is wise, and what is less wise. Yet majorities are quite prone to take their position as being right, come what may, while the minorities get bitter and feel that they are equally right and that those of the majority are blinded by their business positions. And the fight is on.

But with all the difficulties of these days, the oil industry clearly has made great progress in working through its democratic groups, its associations and their committees and these industry committees that have collaborated on war matters. The degree of co-operation, in view of the vigor of the competition within the industry, in most any observer's opinion, is remark-

able. The millennium has not arrived and we hope it never will arrive, because too much agreement might indicate a lack of competition and that would be bad for the industry as well as invite the attention of the department of justice.

Perhaps it is better to say that Director Dodge was talking to this new committee about making its membership, its meetings and its discussions "more democratic," because even democracy is a thing of degree and, in oil we believe, degrees of progress. The East Coast industry committees, and the men who have to do business with them, have made much progress in their thinking and doing, and, NPN believes, they will continue to show progress, thanks to leadership such as Will Dodge has given them as well as thanks to the particular advice he gave them the other week.

Judge for Yourself! Do You Agree That OPA Has Put The Oil Industry on a Sound Operating Basis?

THE PRICE OF OIL, as well as many other things in this country, is so mixed up with screw-ball thinking, misinformation, fourth-term politics and down-right falsehoods, that it is difficult to figure out how to make a dent against it all. The mixture just flows from Washington as an avalanche. About all one can do is to pick out a point and with it, try to illustrate the oil industry's unfair predicament.

OPA Chief Chester Bowles, after his recent appearance before a Congressional investigating committee, sent over to Congress a letter and a folder of some alleged facts about oil supply and the refusal of OPA to increase that supply by permitting an increase in price. Under the circumstances, Bowles escaped cross-examination on this information.

General Counsel Brown of the Independent Petroleum Association of America, has made several critical comments to Congress and the press on these latest Bowles statements, to show how inaccurate and unfair they are. NPN will take only the last paragraph of Bowles letter in which in large all-embracing sentences, he says,—

> "We feel sure you (the Congress) will agree that the policies followed by OPA in controlling prices will prove and is proving of lasting benefit to the industry and the country as a whole. Besides saving the public as consumers and taxpayers hundreds of millions of dollars, price control has placed the industry upon a sound operating basis which has virtually eliminated the possibility of drastic post war readjustments."

Here are some of the things OPA's oil policy has bestowed upon the country and the taxpayers—the car owners,—

It imposed an oil shortage on this country so severe that supply for our absolutely essential needs is seriously threatened;

It deprived the taxpayer and motorist of the few gallons of gasoline he needs in his daily living, on two false assumptions:

(a) that the motorist, for some unknown reason, would rather save a few cents a week in his gasoline expenditure than use his car;

(b) that the 10 or 20c or so a week more that the average motorist might pay for a reasonable advance in crude prices that would get more drilling done, would bring "inflation", whereas the few cents additional for gasoline is but an infinitesimal part of the average car owner's increased income and many of them are spending hundreds of times that for more whiskey.

(Incidentally, neither OPA nor the New Dealers have ever indicated any willingness to let the people decide whether they would prefer to pay a few more cents per week and have more gasoline.)

OPA, through its stringent and uncalled-for price policy on oil, has found it necessary, or perhaps has created the shortage as an excuse, to impose on the American motorist one of the greatest and most inefficient government controls in history, a control which is giving thousands of radical reformers unnecessary, unconstitutional and unAmerican power over American business, and particularly over small business.

OPA's price and shortage-of-supply policy is hitting with increasing severity at the body of greatest competition in the oil business—the Independents—as if OPA, or its bosses in the White House, are determined to drive the strong army of Independent competitors out of the oil industry.

OPA Chief Bowles says in his letter he is "saving hundreds of millions of dollars". In a folder of charts that he also gave to the Congressmen, he claims a "saving" to the government of $175,000,000 and to the public of $350,000,000 more. How these figures are arrived at he does not say. But as offsetting figures we might suggest the $134,000,000 the Army is spending—or wasting— on the Canol project, the $30,000,000 Secretary of the Interior Ickes wants to spend to put the Bureau of Mines into the gasoline-from-coal-business, and the $175,000,000 President Ickes of PRC wants to spend on an Arabian pipe line to say nothing of almost as much more, reportedly, on a Mediterranean refinery. Add this up and it comes close to a half billion dollars, all of which the oil industry was and is only too glad to keep from loading onto the public. The White House backers of the schemes are the same backers of OPA's oil shortage policy.

But the greatest misstatement of all by Bowles is that "price control has placed the industry upon a sound operating basis which has virtually eliminated the possibility of drastic post-war readjustments".

That misstatement alone shows the abyssmal ignorance of Bowles and his White House supervisors concerning the oil industry. A "sound operating" oil industry is not one with idle refining capacity as at present, thanks to OPA's price policy, and with idle distributing facilities, as at present, also thanks to that same price policy. A "sound" industry is not one with a price structure based on the large per cent of big volume of government business done practically exclusively by the major oil companies. A sound oil industry is not one that is drawing its below ground and above ground stocks of oil down to unprecedentedly dangerous levels, so that the oil authorities are constantly hedging every statement concerning the doling out of supplies to the private consumer with the qualification "subject to local shortages" which are nothing but shortages of needed working stocks. Nor is a "sound" American oil industry one subjected to a domestic oil shortage policy that forces the diversion of more and more much needed tankers to South American oil supplies and the carrying out of an alleged "Good Neighbor" policy that might far better be foregone in favor of a "Good American" policy.

One thing certain is that if and when the administration takes its heavy hand off price, the leaping post-war demand will jump the price, undoubtedly higher than any needed price today, in order to bring in the direly needed additional supplies of crude. Another thing that is certain, is that when that higher price brings in the almost certain flood of new crude, the price will fall, perhaps to present levels, maybe even lower.

Maybe one thing the New Deal's economists do understand, is that shortages bring higher prices and higher prices bring additional supplies and additional supplies mean the end of

(*Continued on p.* 54)

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MOTORS AND CONTROL

PAW Materials Chief Links Industry Effort to Battle Fronts

Accent in Global Warfare Is on Petroleum, Parsons Tells Buyers' Group; Reports on Functioning of Various Claimant Agencies

NPN News Bureau

NEW YORK—Following is the text of an address, "Supplies for Victory," delivered by C. P. Parsons, director of materials, PAW, before the Oil Company Buyers' Group of the National Assn. of Purchasing Agents here May 30:

The title assigned for this address is short and to the point, but it could be more rightfully transposed to "Men for Victory—Materials for Men!"

Materials for young Bill Smith, your son or mine, who supplies the courage and the blood for victory.

In olden wars, we have often heard historical remarks that armies marched "on their stomachs". Seems like the accent was on food.

Napoleon ranged far, and the farther his foot-soldiers roamed, the more the accent on food. The staying quality of Washington's Continental Army was more dependent upon food than upon the powder-horn and musket. And the Blue and Gray of the Civil War tramped back and forth over the Mason-Dixon Line for four years "on their stomachs," so to speak. The accent on food began to shift during World War I when armies capable of marching on their stomachs settled down into trench warfare. A few planes roared overhead and tanks were born.

In today's global war the accent is definitely on petroleum, because more than 60% of the tonnage of supplies shipped from our shores to our combat forces in the four corners of the world consists of petroleum products.

Now don't let me give you the impression that young Bill isn't hell-bent for the chow-line—no sir!

But where is Bill?

Chances are, he is moving all over the earth in some type of petroleum-fed war wagon.

Oceans Just 'Wet Spots' Now To Our Intrepid Airmen

There are so many airplanes flying to the four corners of the world that the oceans have been practically dehydrated. To the American Air Forces, oceans are merely wet spots between two landing strips. Petroleum-powered air invasion has been pounding at enemy bases for months, a softening-up process while the petroleum-powered Navy and Maritime pile up men and supplies for ground invasions.

Invasion for what?

Are we out for conquest and the setting up of an American empire?

The answer is no. Although we have the mightiest petroleum-powered force on earth, we are using it to liberate conquered peoples and return their own lands to them; and to protect our own land and people from the most vicious scourge of aggression the world has ever known.

That's why we have "D" days.

Overhead is an umbrella of swift, petroleum-powered air fighters. Petroleum-powered landing barges ram the shore lines and out pours Bill and the other brave lads who are carrying the brunt of man-to-man fighting. But along with Bill, petroleum-powered bulldozers move ashore to clear away the rubble, to fill shell holes and bomb craters, to smooth out landing strips. Petroleum-powered tanks are unloaded to move ahead of the men. Petroleum-powered trucks, bearing howitzers and ammunition, roll off the barges and, with low air-pressure in their petroleum-synthetic tires, roll up the sandy beach to a location where the howitzers can lay a barrage ahead of the brave lads who are fighting their way into the jungles of the South Pacific or through the camouflaged defenses on the European continent.

Up to the present war the old adage "an army marches on its stomach" was undoubtedly correct but in today's global conflict the accent definitely is on petroleum.

Claude P. Parsons, PAW materials director, pointed up this well established fact in an address May 31 to the Oil Company Buyers' Group of the National Assn. of Purchasing Agents in New York.

In his talk, presented here in full, Mr. Parsons explains the functioning of his office in obtaining the necessary supplies for the oil industry to enable it to do its job in backing up the fighting fronts, gives a resume of what has been accomplished in the face of great handicaps and submits a forecast on future prospects.

But that is Bill's job.

What is ours?

We in the petroleum industry carry the great responsibility of providing young Bill with the amazing tonnage of petroleum life-blood for his mechanized units to enable him to move speedily over skyways, sea lanes, and beachheads in his unselfish service to liberate humanity. We must not fail!

To us, war supplies mean aviation gasoline for the air forces; gasoline and countless other petroleum products for the ground forces; fuel oil for the Navy and convoys; gasoline, fuel oil, and lubricants for war industries; ingredients for synthetic rubber; toluol for TNT; and a long miscellaneous list, from medicines to insecticides. The staggering tonnage of petroleum products needed for this war requires the drilling of thousands of wildcat wells; the domestic production of almost five million barrels of oil per day; the refining capacity to transform the crude oil into petroleum products; and transportation facilities to convey the crude oil to the refineries and the refined products to the distribution points where they go to Bill and his buddies.

To meet its tremendous responsibility, the petroleum industry must also have supplies, as well as the Army, Navy and Air Force which it serves. Or, as we call it, we must have MATERIALS!

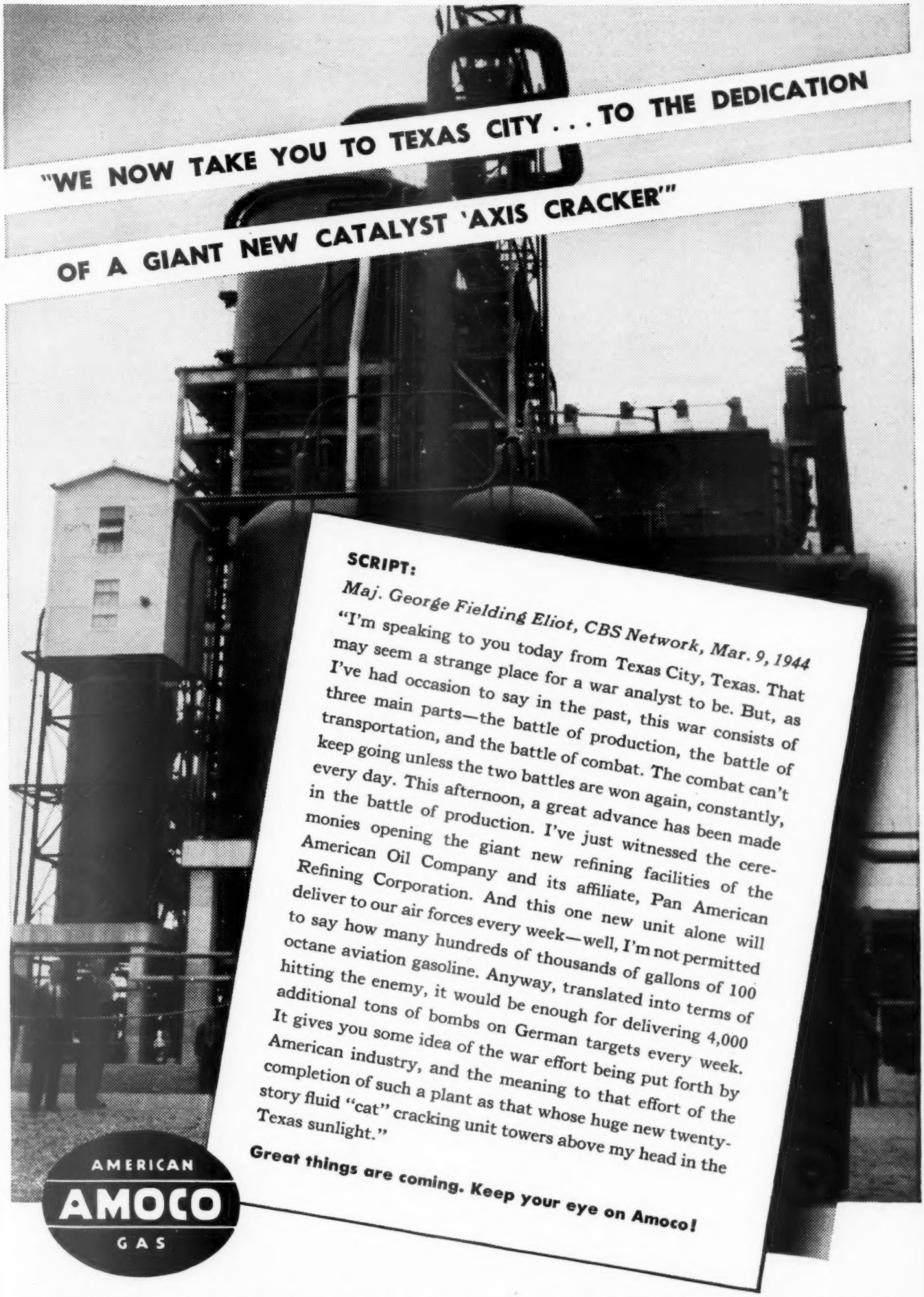
In general, it is obvious that during a war, manpower, raw materials, components, and certain completely fabricated items of equipment are in great demand by the military forces, and a critical shortage results in the supply of many items needed for essential civilian war activities. The petroleum industry, although playing such a vital part in today's mechanized, fluid warfare, has not generally been recognized as a direct part of the military force and therefore must obtain supplies in the general scramble for what is left.

Without some central means of considering, weighing, and co-ordinating a balance between the armed forces and essential war industries in the matter of critical materials, there would be a chaotic scramble. Obviously, the result would be disastrous. The War Production Board was set up to provide this central medium to apportion the critical materials and fabricated items to the military forces and to various industries and individuals in an equitable manner based upon their respective essentiality and urgency to the war program. Especially in a highly mechanized war like this one, relative essentiality and urgency between military activities and war industries is a patch-quilt of complexity. Certainly, there is no question about top ranking for Bill and his buddies in combat; but next to combat, some of the military activities are more essential and urgent than some of the activities of war industries, but some of the war industries are more essential and urgent than some of the military. And, to make matters more complex, the pattern shifts from time to time. Consequently, it takes constant watchfulness to even try to keep pace with it.

In an attempt to co-ordinate, and to bring the complexities out into the daylight, the War Production Board recognized the advantages of having each major branch of the military and each major branch of civilian activity represented by a specialized branch of the Government, to be known as a Claimant Agency. The general purpose of each of the agencies, now numbering 13 in all, is to plan for, claim, and expedite the materials for the activity it represents.

Explaining the Operation of Controlled Materials Plan

The War Production Board, after first trying several other methods of apportioning raw materials to the various Claimants, tried out and established a procedure known as the Controlled Materials Plan. This plan has been very successful in providing each Claimant Agency with a means for planning an over-all materials program for critical raw materials, on a quarterly basis, for the activity or industry it represents; to present its quarterly program of requirements before the War Production Board with all the other Claimant Agencies, including the Military, and to plead their various degrees of essentiality and



"WE NOW TAKE YOU TO TEXAS CITY . . . TO THE DEDICATION OF A GIANT NEW CATALYST 'AXIS CRACKER'"

SCRIPT:

Maj. George Fielding Eliot, CBS Network, Mar. 9, 1944

"I'm speaking to you today from Texas City, Texas. That may seem a strange place for a war analyst to be. But, as I've had occasion to say in the past, this war consists of three main parts—the battle of production, the battle of transportation, and the battle of combat. The combat can't keep going unless the two battles are won again, constantly, every day. This afternoon, a great advance has been made in the battle of production. I've just witnessed the ceremonies opening the giant new refining facilities of the American Oil Company and its affiliate, Pan American Refining Corporation. And this one new unit alone will deliver to our air forces every week—well, I'm not permitted to say how many hundreds of thousands of gallons of 100 octane aviation gasoline. Anyway, translated into terms of hitting the enemy, it would be enough for delivering 4,000 additional tons of bombs on German targets every week. It gives you some idea of the war effort being put forth by American industry, and the meaning to that effort of the completion of such a plant as that whose huge new twenty-story fluid "cat" cracking unit towers above my head in the Texas sunlight."

Great things are coming. Keep your eye on Amoco!

AMERICAN AMOCO GAS

AMERICAN OIL COMPANY *and its affiliate* PAN AMERICAN REFINING CORP.

urgency until a final determination is made of the allotment of raw materials to each Agency.

After receiving a quarterly allotment, a Claimant Agency representing a war industry is charged with the responsibility of properly distributing and accounting for raw materials to companies and individuals on the basis of relative essentiality and urgency.

In addition to claiming and allocating raw materials, a Claimant Agency, together with WPB, must assist the industry it represents in removing shortages and bottlenecks in supply of critical components and completely fabricated equipment. This it does partly by individual expediting and partly by group meetings with other agencies before divisions of the War Production Board.

The Petroleum Administration for War has been recognized by the War Production Board as the Claimant Agency for the petroleum industry. To function as such, PAW has organized a Materials Division and five major Operating Divisions representing the various branches of the petroleum industry: namely, Production, Refining, Supply and Transportation, Distribution and Marketing, and Natural Gas and Natural Gasoline. Each operating division, in co-operation with the petroleum industry, figures a quarterly program of petroleum operations and then, in co-operation with the Materials Division, estimates the amount of raw materials required. The Materials Division then compiles all of the estimates into a quarterly materials program for the entire petroleum industry and then prosecutes the program before the various divisions and committees of WPB to the final determination.

Supply Balances Needs So Far But There Are No Surpluses

In addition to claiming for raw materials for the various operating branches of the petroleum industry, the Materials Division also claims for the manufacturers of petroleum equipment. It also processes and obtains allotments of materials for construction projects such as refineries, pipelines, repressuring plants, manufacturing plants, etc.

How the raw materials flow from our allotments to the various mills, factories and distributors to petroleum operations is well known by you gentlemen of the oil equipment purchasing group.

So far, PAW as Claimant Agency for the petroleum industry has been able to keep the supply of raw materials in balance with an increasing petroleum program, but there has been no surplus. The petroleum production program has been one of gradual expansion from 16,000 wells drilled in 1942, to 19,000 wells drilled in 1943, and 24,000 to be drilled during 1944. We expect to provide raw materials for this program during the third and fourth quarters of 1944, but not without constant attention to details because the over-all materials situation remains tight, mainly due to shortages of manpower.

Even steel ingots are variously estimated as facing a decline of from five to ten per cent in capacity during the third quarter due to the manpower shortage. It is expected that other raw materials will be similarly affected by the manpower shortage during the third quarter.

You gentlemen are undoubtedly interested in knowledge of the current situation as to critical components and completely fabricated items, especially those which are bottlenecks in the oil fields. There will always be such bottlenecks from time to time so long as the war causes shortages in manpower and facilities. At present we are bothered with serious shortages in drill pipe, tool joints, internal combustion engines, heavy trucks, tractors, bearings, wire rope, lumber, manila cable, and several other items.

During the third quarter, the petroleum program will get sufficient raw materials; but shortages will be felt in shapes, components and finished equipment, mostly due to the increasing shortages of manpower. There is general realization that manpower shortages in the foundry and forge industry is the basic cause of increasing shortages in

C. P. Parsons . . . recounts "Bill's job" and ours

many critical components and completely fabricated items. An official release from WPB, dated May 17, states that in the face of decreasing manpower, the foundries will be faced with 20 per cent higher war-equipment schedules by fall. "Our whole economy will break down," the release states, "unless we lick this bottleneck." Steps involving adjustments to frozen wages, to attract American unskilled and semi-skilled labor, and the importation of Mexican labor to clean castings, are under consideration.

Drill pipe continues to be tight, but is expected to ease somewhat by the end of the third quarter. The mills expect to continue producing at maximum rates during the second, third, and fourth quarters, as in the first quarter. If this expected production holds firm, the mills should have produced approximately 8,500,000 feet of drill pipe during 1944. No additional mill capacity is available and relief can only come by careful distribution and use of what is being produced.

Gain in Tool Joint Production Expected in Third Quarter

The tightness of tool joints continues, as indicated by a present backlog of 246,000 and a production of 7500 joints weekly. Production is expected to increase gradually to 8500 or 9000 early in the third quarter. Additional facilities now under way should increase production to approximately 15,000 weekly by the end of the third quarter or early in the fourth.

The manufacturers of rock bits are likewise increasing their facilities, and increased results should be felt during the latter part of the third quarter or early in the fourth. Meanwhile, the balance between supply and demand will remain very delicate.

The largest use of copper products by the oil industry is in the form of Admiralty metal condenser tubes in sizes ⅝, ¾ and 1" OD. The expected over-all productive capacity of the mills to manufacture tube and pipe has been overallotted by approximately 23 per cent, but the copper division of WPB feels confident the mills can produce stated requirements for the petroleum program.

Anti-friction bearings are still tight and the demand far exceeds the supply. Only the most urgent needs can be supplied and there is no indication at present that the situation will change for the better very soon. The bearing section of the PAW Materials Division will continue to expedite urgent petroleum cases. Since the Section was started in December 1943, 14,986 bearings have been expedited. During the past week, requests were received for expediting 12 different types and sizes and involving 244 bearings. Four bearings were for the repair of two drilling rigs; 18 were for a refinery in Bahrein; four were for production of a pump required to complete construction of a 100-octane refinery.

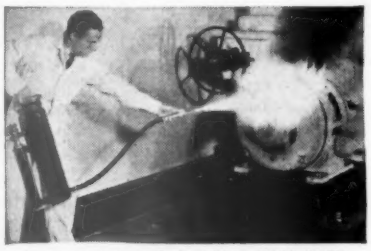
Lumber has reached a very critical stage and all possible conservation of its use should be exercised. During 1943, the use of lumber far exceeded the supply. To overcome this situation, the first step in lumber control has been taken by Order L-335. Under the order, consumers who used more than 50,000 board feet in the last quarter of 1943, or who needed more than 50,000 board feet in either the second or third quarter of 1944, were required to file Application Form WPB-3640 by April 25. For a while at least, lumber for petroleum produced operations is exempt from the Order, since it is already authorized. The filing of these Applications for other petroleum operations has now taken place and are being assembled for review by the lumber division of the War Production Board. PAW has submitted its estimate of the requirements for lumber for the petroleum industry in the second and third quarters of 1944 to establish a reserve for the industry. The War Production Board is assembling data on all lumber requirements for consideration with the estimated supply and will determine final allotments for each Claimant. This procedure is now in progress and allotments should be issued to the Claimants very soon. At that time, processing of the WPB-3640 applications will be com-

This 10x10' pit of flaming oil and gasoline was extinguished in 6 seconds by the "ALL-OUT" Fire Extinguisher. The powder cloud creates a heat-insulating screen, protecting operator from radiant heat.

to extinguish FIRE on the INDUSTRIAL FRONT

The workman who attacks fire with the new "ALL-OUT" Dry Chemical Extinguisher is *fully armed* to extinguish quickly both flammable liquids and fires in electrical equipment . . . *fully protected* against radiant heat and electrical shock.

The "ALL-OUT" Extinguisher discharges a stream of "ALL-OUT" Dry Chemical that instantly generates a dense, fire-smothering, heat-resisting cloud over a flaming area up to a distance of 18 feet. This chemical cloud—clean and harmless to the operator—will not scratch, stain, nor mar either highly polished surfaces or the moving parts of motors and machinery.



A non-conductor of electricity, "ALL-OUT" Dry Chemical is especially effective and safe on fires in heavy electrical equipment — motors, generators, condensers, cable ducts, dynamos, oil switches, transformers, etc.

The "ALL-OUT" Extinguisher extinguishes stubborn, hazardous running gasoline fires in a matter of seconds. Two seconds after this picture was exposed, this running gasoline fire was completely out.

Even though fire may strike in almost inaccessible places, "ALL-OUT" is sufficiently light to carry and operate by men or women workers under the most difficult circumstances.

IMPORTANT "ALL-OUT" FEATURES

Weighing approximately 37 lbs. fully charged, the "ALL-OUT" Extinguisher is ruggedly constructed and *easy to carry and operate* by men or women employees . . . larger opening into powder container, and exterior mounting of the 5½ oz. carbon dioxide cylinder permits *quick, on-the-spot recharging* without special equipment at the scene of fire . . . method of introducing carbon dioxide pressure into chemical chamber produces *heavier* and *denser cloud* of fire-killing "ALL-OUT" Dry Chemical . . . special formula of "ALL-OUT" Dry Chemical creates an insulating film on hot metal surfaces and *helps guard against re-flash* . . . fan-shaped nozzle causes chemical to be projected in a flat stream that *separates the flame* from the burning material . . . Squeeze-Grip nozzle gives *instantaneous* and *positive control.*

See The "ALL-OUT" Extinguisher Demonstrated. Write Today For Your Copy Of This New, Illustrated Folder, And The Name Of Your Local "ALL-OUT" Representative.

"ALL-OUT" "Fatal to Flame"

NATIONAL POWDER EXTINGUISHER

CORPORATION

50 ROCKEFELLER PLAZA, NEW YORK 20, NEW YORK

pleted and authorizations will be forwarded to the applicants.

All manila cable has been coming from a stockpile, there being no new production due to the loss of the raw material to the enemy. We have just been informed that henceforth the stockpile will be used exclusively by the military. Sisal or wire line has not been acceptable as a substitute to eastern operators who are drilling in shallow, hard-rock territory. According to the drillers, wire line does not let the tools fall right and the stresses set up on the old drilling rigs shake them apart. Sisal is not rugged enough. We are endeavoring to get a continuance of supply but, as with all materials that come from a diminishing stockpile, petroleum operators are operating on borrowed time and substitutes must be studied, tried, and used.

Manufacturers of pre-fabricated steel buildings, such as steel belt and engine houses, meter and tool houses, booster stations, and oil derrick dog houses, may now resume the manufacture of such buildings by filing their CMP-4B applications with the Metal Building Materials Section, Building Materials Division, War Production Board. For the petroleum operator to obtain these buildings, it is only necessary that he conform to the requirements of PAO-11 with respect to authority to erect such buildings. Under PAO-11, a building which comes within the definition of lease equipment —that is, one which is located in or adjacent to any oil field—may be erected without the need to obtain any prior specific authorization. The order itself grants a blanket authorization, furthermore, steps are being taken to further simplify other petroleum industry construction projects.

Plan Worked Out With ODT To Get More Trucks

The truck situation improved during April, with more than 400 new trucks of all types except the heaviest (6 x 6) going to petroleum production and refining operations. The general tightness can best be realized from the figures confronting ODT. For 1944, there will be a supply of only 88,000 trucks for civilian use, as compared with a 1941 demand of 700,000 and a five year prewar average of 450,000. Although the situation showed improvement in April, it is obvious that ODT simply does not have enough trucks to keep the petroleum industry rolling. To follow up our recent survey, we have just worked out a plan with WPB, with full approval of ODT, to get more trucks produced for petroleum. The plan will be announced soon through our district offices.

Internal Combustion Engines—there's the hot potato of materials!

You have all heard about the ship's parrot who, after the transport was suddenly torpedoed and sunk, was standing on one end of a piece of driftwood studying a famous magician who was weakly hanging on the other end. Before the torpedo hit the transport, the magician had been entertaining the troops. He borrowed the ship's parrot and was holding it out at arm's length and was going to make it disappear. Then came the explosion and everything went black. When the magician came to, he was clutching the log. He looked up and there was the parrot, wearing a worried look. Presently the parrot opened up with, "Say, Mister, I got on to most of the tricks you did, but what'n'ell did you do with that ship?"

That's about the way it goes with engines.

During the first quarter, there were 2700 engines on manufacturers' schedules for petroleum operators and, so far as we can determine, 1200 were received. It seems like every branch of the Armed Forces uses engines and can't get enough. In addition, there are engine manufacturers' bottlenecks that have hurt production. When the end of a month comes, the engines scheduled are simply not produced. WPB is now trying to make the schedules more realistic. Perhaps they will be based upon foundry casting capacity, because lack of sufficient castings has been a considerable factor in the problem.

On the other hand, reports show that engine repair parts have begun to flow through distributors to petroleum operators as the result of the AA-1 rating recently obtained for distributors and of the many contacts our engine section has made with engine manufacturers.

One way in which petroleum operators can help eventually to lick the engine problem is to enter purchase orders for their engine requirements through 1945. Schedules are now being filled for the second quarter of 1945 and unless orders are placed, there is a certainty that there will be no engines.

The above facts develop in daily contacts of the Materials Division with various Divisions and committees of the War Production Board and with other Claimant Agencies.

Without such facts, petroleum operators are thrown open to guess-work. Some operators who have had difficulty in obtaining materials may be overly pessimistic. Some, perhaps, have not understood the setup of the Materials Division and therefore have not utilized the services rendered to the petroleum industry. On the other hand, many operators who have been getting a satisfactory amount of materials may become overly optimistic by not being aware that the satisfactory amount of materials received has been the result of careful

Cliff Hopping Fuel to Our Forces in Far North

Coast guardsmen, attached to a remote outpost in the Far North, haul drums of oil up the rocky cliffs by employing lines and pulleys to good advantage. This Arctic duty is no spot for the tenderfoot. It calls for strong men and makes them stronger

Oil for the Lamps of China

Official U. S. Navy Photo

THERE are lamps in China that have shed no light for years. They are the lamps of Freedom, of Hope, and of Happiness.

Today those lamps are beginning to glow again. Faintly at first, but with a flame that burns ever stronger, they are piercing the darkness that enshrouds them. The fuel that gives them light is the oil that feeds the vast armadas of planes and ships that are moving relentlessly Westward —oil that America knows will some day make the Lamps of China burn as brightly as her own.

華燈常明

★ ★ ★

The manufacturers of Tri-Sure Closures feel gratified that their seals—which protect so much of America's oil supplies — are helping to safeguard "Oil for the Lamps of China."

AMERICAN FLANGE & MANUFACTURING CO. INC., 30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.
TRI-SURE PRODUCTS LIMITED, ST. CATHARINES, ONTARIO, CANADA

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Reg. U. S. Pat. Off.
CLOSURES

planning, constant watchfulness, and work on the part of their Claimant Agency. Some may even feel that there is an abundance of materials and there may not be any further need for restrictions and allocations on the basis of essentiality and urgency. How we wish this were true!

Young Bill wants to go home—so do we.

Future Prospects Must Wait Outcome of Invasion

In summary, while we have been able to keep the supply of raw materials in balance with an increasing petroleum program, there is no indication that in the third quarter the materials situation will become sufficiently easy for restrictions to be lifted at a faster rate than they have been lifted so far this year. We will, however, continue to lift them if the situation continues to become easier; but if materials become tighter due to manpower shortages and critical changes in the Military requirements, due to success or failure of the war program, we may even have to increase restrictions.

It must be remembered that our military forces have not yet engaged in a major European campaign, and until the outcome of this campaign is known, the future status of materials will remain in doubt. For instance, it is reasonable to assume that the Army has already planned the provision of sufficient materials to carry on, assuming major military operations in the immediate future are successful. But, on the other hand, if serious setbacks should occur, the military may come up with new demands not now foreseen. A good example of this is seen in the large and extremely urgent program launched a few months ago for heavy artillery and heavy gun ammunition.

From another angle, there are Claimant Agencies which have not been afforded the same degree of essentiality or urgency as the petroleum program, which ranks close up to the military. These agencies have been repeatedly turned down on programs which they have submitted, but they are eagerly waiting to claim any materials made available by a cut-back in military requirements. We must ever be ready to demand that the petroleum industry receives due consideration.

It is hoped that knowledge of the above facts and trends will help petroleum operators in some way to maintain their very difficult and very great responsibility to young Bill. Without 100-octane gasoline in the air, he would have to sacrifice the advantage of superior power. Without 'gas' at all, what good is a P-38. An empty gasoline tank in any mechanized war wagon does no good for Bill. We must provide him with sufficient life-blood for his mechanized units so that we minimize his chances of needing plasma for himself.

Where to Go and Whom To See on Dist. 3 Industry Problems

Key Officials of PAW, OPA and ODT and Their Addresses Listed

Special to NPN

HOUSTON, Texas—Oil men in Dist. 3 of PAW who are confronted with problems growing out of the war effort can contact the following persons for assistance.

PETROLEUM ADMINISTRATION FOR WAR—W. M. Averill, director in charge, Dist. 3, 247 Mellie Esperson Bldg., Houston 2, Texas, Phone Charter 4-4731. Nine sub-directors or department heads, handle their related subjects.

All maintain offices in the same building and can be reached through the same telephone exchange as the district director. The list of division heads follows:

R. L. Carruthers, acting district director of production.

H. M. Brown, district director of natural gas and natural gasoline.

H. Leyendecker, acting district director of transportation.

G. T. Granger, district director of refining.

J. B. Thompson, district director of materials.

E. J. Dorgan, Jr., district director of marketing.

D. P. Sturges, district director of construction.

K. Earhart, district director of facility securing.

D. E. Cornell, district counsel.

***OFFICE OF PRICE ADMINISTRATION**—839 Electric Building, Houston 2, Phone Capitol 7201, Stephen J. Tully, Jr., district director. Assistants are:

Harvey Smith, rationing executive.
H. T. Jonsson, mileage rationing officer.
Ed Tully and Fred Selby, attorneys.
John A. White, district price executive.
Charles P. Seiss, gasoline and tire prices.
F. A. Moore, Jr., machinery pricing.

***OFFICE OF DEFENSE TRANSPORTATION, Frank S. Woodard,** head of motor transport division, 927 Electric Building, Phone Capitol 7201.

T. E. Ferris, assistant manager.

*Jurisdiction confined to Harris and 40 other Texas counties.

66 Oil Industry Committees Will Advise OPA

NPN News Bureau

WASHINGTON—OPA reported this week that 66 gasoline industry advisory committees have been organized to work with OPA district offices. OPA said members of the committees are appointed by district mileage rationing officers to reflect all elements of the gasoline industry in any district. They contain representatives of both dealers and distributors, major and independent companies with co-operatives, "trackside" stations and other types of marketing organization represented where they exist.

Meeting regularly with district rationing and enforcement officials, committees will be in position to bring about fuller understanding between OPA and the industry at the "grass roots" level.

OPA field offices have so far reported the establishment of committees in the following cities.

REGION I, (Boston). State committees established in Maine, Vermont, New Hampshire, Rhode Island, and Connecticut.

REGION II, (New York). Syracuse, N. Y., Harrisburg, Pittsburgh, and Philadelphia, Pa.; Baltimore, Md.; Newark, N. J., and Wilmington, Del.

REGION III, (Cleveland). Cincinnati, Cleveland, Akron, Canton, Youngstown, Mansfield, Columbus, Toledo and Lima, Ohio; Detroit, Grand Rapids, and Saginaw, Mich.; Indianapolis, Ind.; Lexington, Ashland, Louisville, Owensboro, Paducah, and Bowling Green, Ky.

REGION IV, (Atlanta). Birmingham, Montgomery, Ala.; Jacksonville, Fla.; Charlotte and Raleigh, N. C.; Nashville, Tenn.; Jackson, Miss.; Richmond, Fredericksburg, Norfolk, and Newport News, Va.

REGION V, (Dallas). Little Rock, Ark.; New Orleans, Shreveport, and Monroe, La.; St. Louis, and Kansas City, Mo.; Oklahoma City, and Tulsa, Oklahoma; Fort Worth, San Antonio and Houston, Texas.

REGION VI, (Chicago). Des Moines, Iowa, and Milwaukee, Wis.

REGION VII (Denver). Denver, Colo.; Cheyenne, Wyoming; Helena, Mont.; Boise, Idaho; Salt Lake City, Utah; Albuquerque, N. Mex.

REGION VIII, (San Francisco). San Francisco and Los Angeles, Cal.; Portland, Ore.; Seattle, and Spokane, Wash.

Other districts report committees are almost ready to begin operating. Goal is a functioning committee in every district by the middle of June.

Just what can we tell the Marines?

ON THE BATTLE FRONT?

Frankly, nothing!

From the very beginning of this war, against overwhelming odds, the Flying Marines have taken their toll of 5 to 1 in the Pacific. At Wake, Midway, Guadalcanal, and Tarawa they have shown how well they know their business.

So we have no advice to give them . . . no suggestions to make. They know their jobs, and every day their planes are blasting a path closer to Tokyo . . . always closer.

ON THE HOME FRONT?

A few words about us.

Here in America we of the Petroleum Industry are in on the building of those planes the Marines fly, right up to our ears.

From the gleam in the designer's eye, right into the midst of battle, we are beside the pilot and his plane.

For not only are we furnishing hundreds of special oils for manufacturing processes, but we are contributing to the making of synthetic rubber, surfacing compounds, and plastics used in all types of planes.

Then, as these ships roar into battle, 95% of the high-octane gasoline they use . . . 70% of the oil . . . is from the U.S.A.

Gulf, as a member of the fighting petroleum industry, feels it a great privilege to be in such good company.

GULF

Here is the presentation ceremony at which Army's Fuel and Lubricants division received gift of a museum from the oil industry. Left to right, L. P. Lochridge, Sinclair; Allan Hand, secretary of P. I. W. C.; Brig. Gen. H. L. Peckham; W. H. Correa, Socony-Vacuum; Deputy PAW Davies; Maj. Gen. E. B. Gregory, quartermaster general; D. P. Clark of Gulf

Gen. Peckham Reviews Army's Huge Take of Oil, Accepts P.I.W.C. Loan of Technical Exhibit

NPN News Bureau

WASHINGTON—On the first anniversary of the Fuels and Lubricants Division of the Office of Quartermaster General June 1, Brig. Gen. H. L. Peckham, division director, disclosed that his organization during the first year of its existence processed requisitions for the purchase of more than 700,000,000 gals. of gasoline.

Emphasizing the tremendous importance of petroleum for war, the general said that, at times, tonnage of petroleum products shipped overseas had exceeded all other supplies.

Gen. Peckham's revelation came June 1 during special ceremonies in observance of the anniversary. It came as he accepted, on behalf of the Army, an exhibit from the oil industry which describes every phase of oil operation and traces petroleum development as the oil emerges from the depths of the earth to travel through intricate and highly technical processes to the war machines and vehicles of American fighting men on the far flung battlefronts of the world.

The only museum of its kind in the world, the exhibit was presented to the army as a loan for the duration of the war. The presentation was made by a special committee representing P.I.W.C., —W. H. Correa, Socony-Vacuum; D. P. Clark, Gulf, and L. P. Lochridge, of Sinclair.

Also participating in this symbolic salute to the U. S. Army were Deputy PAW Davies, Maj. Gen. E. B. Gregory, the quartermaster general, and Allan Hand, who represented P.I.W.C. Chairman W. R. Boyd, Jr.

For Use in Training

Gen. Peckham said that "since it graphically and vividly portrays not only technical information on petroleum, but the rigorous uses to which it is applied by the Army as well," the exhibit will be used in training and familiarizing officers for overseas assignments.

The division director, speaking later to the Fuels and Lubricants staff, said that not only had the division processed requisitions for the purchase of more than 700,000,000 gals. of gasoline in a single year but had also cleared requests for the purchase of more than 300,000,000 gals. of Diesel oil, 50,000,000 gals. of engine oil, 50,000,000 pounds of grease, 3,000,000 gals. of gear lubricants, 2,000,000 gals. of various special oils, and approximately 12,000,000 tons of coal.

Other achievements of the division included the shipment of 6,000,000 five-gal. cans and 5,000,000 fifty-five gal. drums overseas. Issued for use in the U. S. were 1,000,000 five-gal. cans and 800,000 fifty-five gal. drums. In addition, 400,000 fifty-five gal. drums returned from overseas commands were reclaimed during the year.

Films Show Army Tests

The museum placed in the hands of the division contains models of an oil well and a fractionating tower, such as is used in a modern refinery. There is a cross-section of the 24-in. pipe used in the "Big Inch" pipeline.

The exhibit also contains cut-away models of engines and other parts of Army vehicles. In these the utilization of petroleum products is aptly described. There are four continuous motion pictures showing the actual production, refining, transportation and distribution of petroleum products. The pictures also show tests made of Army vehicles and other equipment to determine desired characteristics in meeting Army standards. One section of the exhibit is devoted to solid fuels, also procured under direction of the division.

Gen. Peckham, in his address to civilian and Army personnel of the division, paid tribute to the "foresight and ability" of Maj. Gen. W. E. R. Covell, who preceded him as head of the division.

"His was the difficult task of initial organization. I know you will agree with me that he built the division on a secure foundation. I hope that in my seven months with you I have made the upper stories of our structure as strong as that foundation," he said.

The general then made clear the reasons why the work of his division is immeasurably important to the success of the Army. He told of incomparable advances made in military equipment since World War I, and how this equipment, as well as the very lives of soldiers, largely depend upon petroleum products. He described it in this manner:

"Today an armored division requires many times as much horsepower as the infantry division of 1918. This same armored division may use more than 50,000 gallons of gasoline in a single day's fighting, as well as large quantities of lubricants.

"Scores of special oils and greases derived from petroleum are doing their share to make our Army the best equipped Army in the world.

"Gasoline is used to cook the soldier's

REFINING NEWS *and* TECHNOLOGY ★

If you are interested in TIRES

Send us this letter

Pennsylvania Rubber Company,
Jeannette, Penna.

Gentlemen:

We understand that your company has a detailed knowledge of oil industry problems ... and that a special staff is prepared to help oil companies select proper lines of merchandise, and to give complete advice on planning, advertising and selling.

Industry figures show that you are large enough to assure prompt, substantial shipments to all areas, yet are not too big to give executive attention to our particular needs.

We've heard that Pennsylvania Tires are the finest tires available for the money ... and that the line offers tires for every wartime need — whether for retail or wholesale distribution, or for our own business vehicles.

Finally, we've been reading about a new Pennsylvania Silent Vacuum Cup tire that will dominate the quality market after Victory.

Because we are thinking seriously about tires now and for the peacetime future, we'd like to talk with you.

SIGNED_____

ADDRESS_____

_____

521

PENNSYLVANIA TIRES

MANUFACTURED BY THE ORIGINATORS OF THE *Silent Vacuum Cup Tire*

Gen. Peckham shows D. P. Clark of Gulf: Deputy PAW Davies and W. H. Correa of Socony-Vacuum, just how one of the exhibits in the new Army museum works

Two of the top figures in the government oil team—Deputy PAW Davies and Gen. Peckham—view exhibit symbolic of the never failing flow of oil to the fighting fronts. Sign over blitz can reads: "Symbolic of the achievement of the quartermaster corps and the petroleum industry is this BLITZ CAN supplying a continuous stream of petroleum products to our armed forces"

meals, to mix the dough for his bread, to purify his drinking water and to operate his radios and other signal equipment; oil is used to heat his living quarters in the Far North, to make artificial fog, and to repel insects; greases and waxes are used in many forms to promote his health and comfort.

"These are but a few of the many uses of petroleum products in our Army.

"Is it any wonder therefore that the tonnage of petroleum products shipped overseas has exceeded at times that of all other supplies? Solid fuels, too, have contributed in a large measure to the war effort by supplying the heat and power required by the posts, camps, arsenals and manufacturing plants of our Army in this country and for its rail transportation and supporting activities overseas."

Reducing Specifications

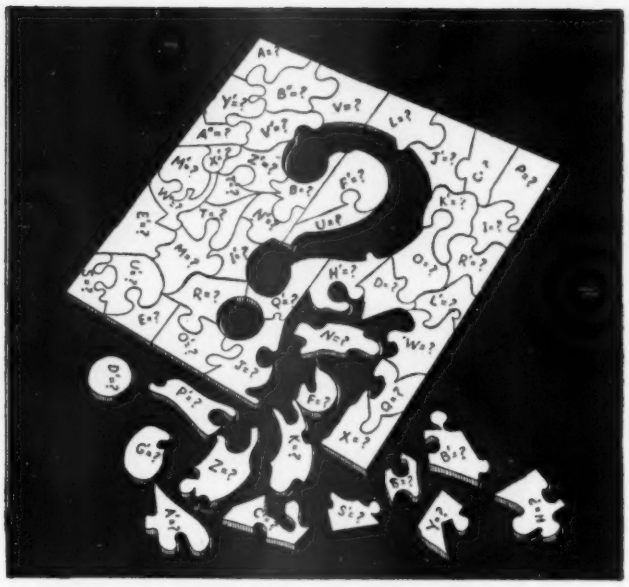
Gen. Peckham declared that it is the division's duty to see that fuels and lubricants shall continue in a never-ending stream to pour into the hands of the fighting men overseas—enough for their best performance—"enough and on time." He added:

"If the locomotives, trucks, tanks, self-propelled artillery, bulldozers, small landing craft, flame-throwers and other equipment being used against our enemies should ever lack the fuels and lubricants which give them life, they would be useless."

The general told of successful efforts of the department in standardizing petroleum products as well as their packaging.

"We are continuing our efforts," he asserted "to reduce the total number of Government specifications and to extend the application of our specifications to British products. This will simplify requisition, purchase, storage and distribution for the Army, and result in sav-

This is one view of the exhibit presented to the Army Fuels and Lubricants division by a special oil industry group appointed by P. I. W. C.'s lubrication and containers committee. The exhibit was designed by A. R. Boehmer of Socony-Vacuum and E. G. Williams of Gulf



Ever try solving 54 simultaneous equations?

REMEMBER the complexity of the simple simultaneous equations of your high school algebra . . . involving but 2 unknowns?

Then you'll really appreciate what mechanical engineers accomplish in establishing the accurate design and specifications for the labyrinths of piping in a modern refinery.

The required piping calculations for even a run-of-the-mill job—involving 18 unknowns—test the mettle and patience of the industry's mathematical specialists. But only M. W. Kellogg can supply the accurate answers to 54, 60 or even 72 simultaneous equations—covering up to 12 points of fixation—as part of its engineering *routine*.

For this purpose, our engineers harnessed electricity and the scale model—evolving an apparatus which is sensitive to deflections of a *millionth of an inch*—to determine the actual stresses and reactions on the full-scale job. The electrical measuring instruments which make possible such accuracy were developed by us . . . are the only ones in existence!

This exclusive apparatus saves our clients untold thousands of dollars. Piping systems in Kellogg-designed refineries are neither over- nor under-built.

Handling piping systems with characteristic extra skill is just another reason why Kellogg mechanical engineers were selected to design over two-thirds of today's Fluid "Cat-Cracking" capacity. But these men—and their experience and equipment—are only one important phase of M. W. Kellogg Complete Service. We evolve the required engineering data. We apply it. We develop process methods. We design. We build. We supervise initial operation. And the finished job must meet a two-fold aim: Total war production now . . . a head-start in postwar competition for our clients.

THE M. W. KELLOGG COMPANY

★Only Kellogg Service Has Them All

★**LABORATORIES**—fully equipped and staffed—devoted exclusively to chemical engineering and process development.

★**24-HOUR-A-DAY PILOT PLANTS**—17 refining processes operating continuously—providing accurate data for commercial scale application.

★**EXCLUSIVE CHEMICAL ENGINEERING DATA**—Continuously compiled . . . embracing both pilot plant runs and the operation of Kellogg-built refineries. Data extends from beginning of modern refining.

★**PROCESS ENGINEERS**—Specialists who have continuously made major contributions to oil refining development, for more than 20 years . . . currently exemplified by their work on fluid catalytic-cracking.

★**MECHANICAL ENGINEERS**—Kellogg installations—worth hundreds of millions—are their best reference.

★**METALLURGICAL LABORATORY**—Establishes continuous check of specifications...creates new techniques for the fabrication of refining equipment.

★**PERMANENT CONSTRUCTION CREWS**—Geared to function all over the world on single units or multiphase refineries . . . team-experience cuts costs, speeds construction.

★**OPERATING STAFFS**—Specialists at placing new units "on stream" . . . training of refiner's own operating crews.

★**LICENSING SERVICE**—Licenses available through Kellogg as Licensor or licensing agent for all types of refining processes.

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ings to industry which should be reflected in lower contract prices."

Observers, he said, who visited American units overseas, consulted with numerous motor sergeants and mechanics, found without exception the opinion that American fuels and lubricants "are giving the performance which we expected of them."

Gen. Peckham also spoke with enthusiasm of the Mobile Petroleum Products Laboratory which has been developed. Several units are already overseas. He told of the training of the key personnel of these units under direction of an officer of the division at the University of Tulsa and the laboratories of the Ethyl Corp., also in Tulsa.

These new laboratories, he pointed out, are capable not only of testing American products for contamination and deterioration, but are prepared to test captured enemy products to determine whether they are suitable for use in American equipment.

He also remarked that the division, within the last few months, had been made responsible for overseas can and drum manufacturing plants. Plants, he said, are now being fabricated in two theaters of operations and some are already in operation.

RECENT PATENTS

REFINING

Treatment of hydrocarbons. Francis C. Moriarty, Chicago, assignor to Universal Oil Products Co. Filed Dec. 8, 1941. No. 2,348,745.

Catalytic conversion of hydrocarbons. Du Bois Eastman and Charles Richker, Port Arthur, Tex., assignors to Texas Co. Filed May 26, 1942. No. 2,348,794.

Hydrocarbon conversion process. Frederick E. Frey, Bartlesville, Okla., assignor to Phillips Petroleum Co. Filed Oct. 7, 1940. No. 2,348,802.

Manufacture of motor fuel. Francis Horton, Riverdale, N. Y., Libbeus C. Kemp, Port Arthur, Tex., and Richard E. Nagle, New York, and Loren P. Scoville, White Plains, N. Y., assignors to The Texas Co. Filed June 20, 1939. No. 2,348,815.

Filtration. Wynkoop Kiersted, Jr., Scarsdale, N. Y., assignor to Texas Co. Filed June 28, 1941. No. 2,348,822.

Catalytic conversion of hydrocarbons. Richard E. Nagle, New York, N. Y., assignor to Texas Co. Filed July 13, 1939. No. 2,348,836.

Combination cracking process. Richard F. Trow, Lawrenceville, Ill., assignor to Texas Co. Filed May 20, 1943. No. 2,348,867.

Treatment of hydrocarbons. Walter Schulze, Bartlesville, Okla., assignor to Phillips Petroleum Co. Filed Dec. 10, 1940. No. 2,348,931.

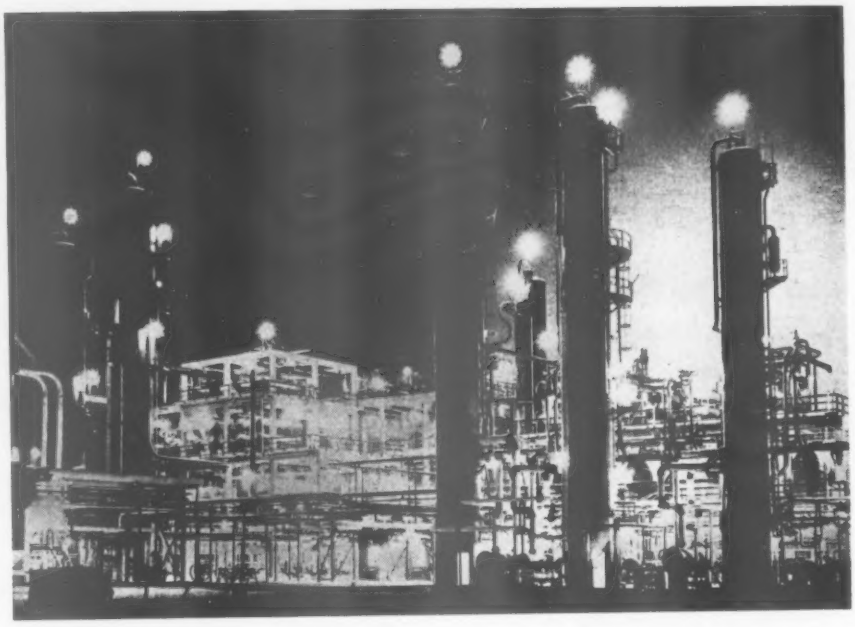
Solvent dewaxing of mineral oils. Luke B. Goodson, Phillips, Tex., James V. Montgomery, Fort Huachuca, Ariz., and Robert W. Henry, Bartlesville, Okla., assignors to Phillips Petroleum Co. Filed Oct. 28, 1940. (2 patents) Nos. 2,349,038 and 2,349,039.

Conversion of hydrocarbons. Ernest F. Pevere, Beacon, N. Y., assignor to Texas Co. Filed March 21, 1941. No. 2,349,053.

Converting hydrocarbons. Frederick E. Frey and Robert D. Snow, Bartlesville, Okla., and Walter F. Huppke, Lomida, Calif., assignors to Phillips Petroleum Co. Filed April 29, 1940. No. 2,349,160.

Compiled by R. E. Burnham, patent and trade-mark attorney, 511 11th street, NW., Washington 4, D. C., from whom copies may be obtained at rate of 25c each. State number of patent and name of inventor when ordering.

Cities Service-Firestone Plants in Action Against the Axis



Night scene of a unit of the Cities Service refinery in Lake Charles, La.. Here several steps are taken to turn out the rough-on-the-Axis 100-octane gasoline. From this unit the aviation gasoline base stock goes to a chemical treating plant where sulfur compounds are removed prior to its being blended into its final state. The new plant was dedicated last week with Deputy PAW Davies as the principal speaker. It will turn out enough aviation gasoline to send 1000 bombers over Germany every 24 hours

Davies Hails Output for 10,000-Bomber Fleets

Special to NPN

LAKE CHARLES, La.—The United Nations oil industry will be producing 21,000,000 gals. of high octane gasoline every day by July 1. This enormous quantity of high octane is enough to send more than 10,000 bombers over Berlin every 24 hours.

This was the declaration last week of Deputy PAW Davies, one of the speakers at the dedication of the new $100,000,000 Firestone-Cities Service high octane gasoline and synthetic rubber plant here. Mr. Davies praised the oil industry for its part in the war effort.

Harvey S. Firestone, Jr., head of the Firestone Tire & Rubber Co., speaking on the same program, predicted that the synthetic rubber industry will play a vital role in the Nation's economic system after the war is ended.

"On May 1," Mr. Davies said, "the United Nations were producing 400,000 bbls. a day of this super fuel. By July 1, I am confident we will be able to hit 500,000 bbls. (21,000,000 gals) a day. In two and a half years, we will have outproduced all of Axis Europe by 12 to one.

"You, as an individual, can take pride in that achievement, for your sacrifices have made it possible. You see, when the Japs struck at Pearl Harbor, we couldn't wait for new plants to be built, so our petroleum chemists went to work and found how to squeeze more 100 octane out of motor gasoline. That's where your prewar quality in automobile gasoline has gone. That's where much of your gasoline itself has been diverted, and some of your heating oil too—into great plants like this, to be conditioned for war in the skies. You are driving less so that more men can fly.

"It is reassuring to know that as the fateful hour of invasion approaches for which our soldiers abroad and those on the production lines alike have been preparing our planes never will lack fuel."

The new plant, which sprawls over 600 acres, will be operated by the Firestone Co. and by Cities Service Co.

W. Alton Jones, president of Cities Service, explained that the latest discoveries and inventions from the laboratories of both the rubber and petroleum industries are incorporated in the plant.

Discussing the postwar era, Mr. Firestone expressed his belief that all synthetic rubber available in the nation and throughout the world would be needed for several years after the conflict has ended to supplement supplies of natural rubber.

Promoted in Imperial Oil

TORONTO—C. E. Carson has been appointed general manager of refineries for Imperial Oil Ltd. He was, prior to this appointment, general superintendent of Imperial's refinery at Sarnia, Ont. He succeeds George L. Stewart, who was recently made vice-president in charge of manufacturing. J. Dean Bradley has been appointed to the post vacated by Mr. Carson.

OIL TRANSPORTATION

West Coast Pipeline Is Vetoed by Ickes; Tankers Preferred

NPN News Bureau

WASHINGTON — PAW Ickes this week gave a flat turndown to request of Pacific War Emergency Pipelines, Inc., of Dallas, for authority to construct 986-mile, 20-inch line for movement of 175,000 b/d of West Texas crude to Beaumont, Calif.

Ickes cited four reasons for rejecting project, as follows:

"1. Requirements for additional crude oil to supply existing refineries in Dist. 1, 2, and 3 are increasing. According to the best available estimates, by the fourth quarter of 1945 these requirements will absorb the entire crude oil productive capacity east of the Rocky Mountains. Under such conditions, there would not be sufficient crude oil available in the West Texas area to sustain the pipe line which you propose to construct to California. These estimates are confirmed by the Petroleum Industry Committee for Dist. 3.

"2. The facility which you propose to construct is much larger than would be required to supply the indicated available refinery capacity on the West Coast, which according to our latest estimates, will not exceed 75,000 barrels a day after utilization of presently available crude oil production in California.

"3. The proposed pipe line, according to the most optimistic estimates, could not be completed before the second quarter of 1945, even with priority ratings. Such being the case, the facility would be of no use during the present period when tankers are not available for equivalent movements. Tankers, on the other hand, can and are being constructed at a much faster rate and for a substantially lesser amount of critical materials would transport the required amount of crude oil to maintain full utilization of available California refining capacity.

"4. From the supporting data on the project we note that no provision has been made for gathering facilities in West Texas and only a nominal allowance made for distributing facilities in California. The provision of such additional facilities would require a substantial increase in both critical materials and manpower over the amounts set forth in your application."

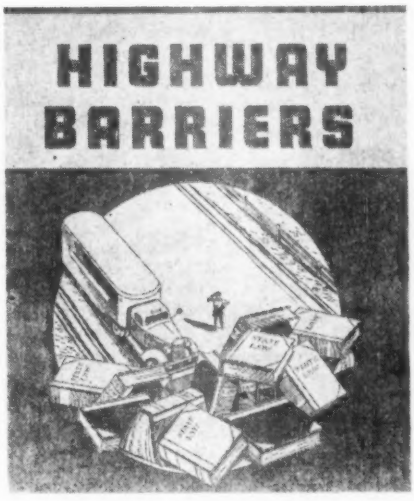
Fruehauf Chief Urges Action to Slash Tangle of Contradictory Truck Laws Hampering Transport

By Herb Taylor
NPN Staff Writer

CLEVELAND—Eighty years after the Civil War, the states of this great democracy still lack unity in far reaching economic matters, and in some respects are as backward as any group of the Balkan nations of Europe. This is particularly true of various state laws regulating truck transportation.

A booklet just issued by the Fruehauf Trailer Co. graphically outlines some of these unnatural barriers to the free flow of trade between the states. It tells of the handicaps facing the over-the-road truck owners today. Many of the regulations border on the absurd; all of them are costly to the shipper, trucking companies and consumers alike.

And for the benefit of those who may point to states like Kentucky or Tennessee as bottlenecks or "black spots" on



How American Trucking Assn., Inc. pictures the contradictory, muddled, and cross-purpose state laws affecting national truck transportation

the truck transportation map, it is pointed out that there are few states immune from trade barriers of one kind or another.

For instance Fruehauf takes a hypothetical case of a man in Iowa wearing shoes made in New York. The Iowa wholesaler places an order for a truck-trailer load. (It could be a load of oil, grease or accessories). Here is what happens. The weight figures are not necessarily up to the greatest legal allowance, because factors of vehicle design sometimes make it impossible to attain the maximum.

The driver starts out in New York with an I.C.C. permit and special plates to proclaim that fact. He is permitted a 50-foot truck trailer unit, having a gross weight for vehicle and load of 50,000 pounds.

Entering New Jersey, the driver learns that he is permitted a length of 45 feet, and a gross weight of 60,000 pounds. So he must do an accordion act with his equipment. But still his unit is underloaded 10,000 pounds according to the New Jersey allowance.

Next he gets into Pennsylvania. Here is where he really gets into hot water, for Pennsylvania is also restricted to 45 feet, but only 45,000 pounds is permitted, 5000 less than in his home state and 15,000 pounds less than in New Jersey and Pennsylvania permitted the don't conform to Pennsylvania's lighting requirements. In addition an 8-mills-per-dollar gross receipts tax must be paid on that part of his total mileage traveled in Pennsylvania.

However, assuming that both New Jersey and Pennsylvania permitted the load of shoes to go through with the original New York vehicle load—which they wouldn't—when the truck reaches Ohio it is five feet over length. But still his truck-trailer would be underloaded some 6000 pounds. Furthermore in the Buckeye State the driver would have to register with the Public Utility Commission and fork over a $72 registration fee.

More Paying in Indiana

If the driver has been able to connive his way through Ohio, he will find that when he gets to Indiana that the vehicle length is five feet less than New York. But the weight allowance is 3900 pounds more. But there is more paying to do. There is a $24 charge for obtaining operating authority from the Indiana Public Service Commission.

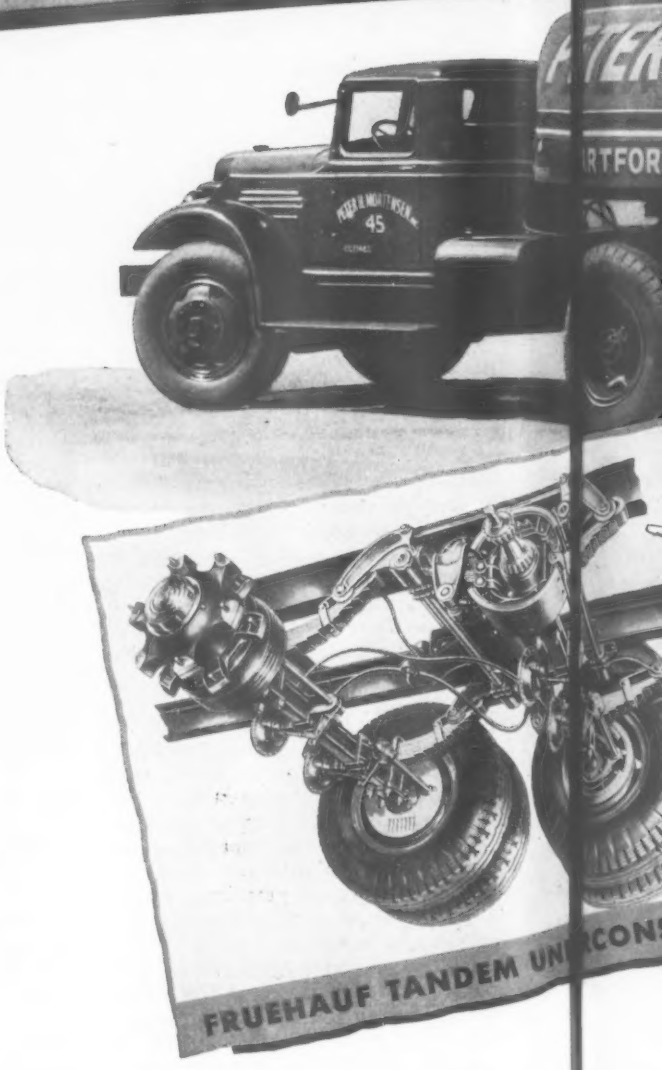
Assuming that he had been permitted to proceed with the original vehicles and load, when the driver reaches Illinois, he must cut his gross weight from 50,000 to 40,000 pounds. He is 15 feet overlength. Illinois vehicle light requirements don't conform with those of New York or Pennsylvania. On top of that, there is the matter of a special gross weight tax of approximately $245 or a mileage fee of 2 cents per mile to be paid.

When the cargo reaches the border of Iowa, it is overlength five feet, but underweight 3900 pounds as compared with New York. The driver will find that if he is to make Iowa part of his regular route, he must buy an annual Iowa "compensation" tag costing $250.

All of these restrictions and conflicting requirements are far from conducive of present or postwar expansion of the bread and butter business of the oil industry. But the case cited, Fruehauf points out —a haul from New York to Iowa—is actually one of those more favorable to motor transport.

Had Tennessee been on the route, for example, the situation would have been even more serious. Here is a comparison between the minimum sizes and weights recommended at the Federal State Con-

A Few *Reasons Why* Petroleum Tra
Choose *Fruehauf Tandem-Axle* Tan



1. The Tandem-type suspension absorbs road stresses and strains—protects the tank from twists which cause leaks.

2. Fruehauf's uniform traction on all 4 wheels gives equal distribution of load on both axles. All 4 tires maintain constant road contact . . . over humps—hollows—and level surfaces alike.

3. Smooth, equalized braking on all 4 wheels eliminates jumping and chattering on rough roads as well as smooth pavements.

4. Chrome-Molybdenum forged I-Beam axles save weight without sacrificing any strength.

5. Four rubber-mounted radius rods insure positive axle alignment at all times. One adjustable radius rod assures perfect alignment originally — makes possible speedy, accurate realignment in case of accident.

• A visit or call to your nearest Fruehauf B ch will the many more outstanding features . . . the sons w Fruehauf Tank-Trailers on the road than an her mak

World's Largest Builders of Tr ailers

FRUEHAUF TRAILER COMPANY •

Service in Principal Ci

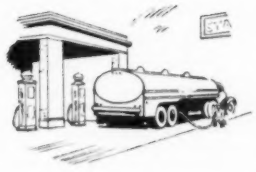
"Engineered Transportation"

Transporters
Tank-Trailers

★ Here is more evidence that transporters, the men whose entire earnings depend upon their operating equipment, choose Fruehauf Tandem-Axle Tank-Trailers. The Tandem gasoline transport pictured is one of the latest built for use in States where multiple axles permit increased gallonage.

uehauf B ch will acquaint you with
s . . . the asons why there are more
than an her make.

uilders of Tr ailers
MPANY • DETROIT 32
Principal Cit



FRUEHAUF TANK-TRAILERS ARE EASY TO HANDLE IN TIGHT SPOTS • •

Drivers know from experience behind the wheel that Fruehauf Tank-Trailers are surprisingly easy to maneuver—far easier to handle than tank-trucks with the same carrying capacity. On busy city streets, up narrow alleys, around the pumps and pillars in filling stations, the hinged-in-the-middle feature of the Tank-Trailer is a real aid to the driver. In cramped quarters the truck turns at right angles to the Tank-Trailer, the Trailer wheels cut in and the unit gets into places you'd find difficult, if not impossible, to make with a tank-truck of equal size.

☆ ☆ ☆ Reg. U. S. Pat. Off.

Fruehauf TRAILERS

ference on War Restrictions and what Tennessee law allows:

	Federal	Tennessee
Vehicle Height, feet	12½	12
Tractor Trailer Length, feet	45	35
Axle Load, pounds	18,000	16,000
Gross Weight, pounds	40,000	30,000

Tennessee has temporarily increased (on permit) length to "over 35 ft." and gross weight allowance from 30 thousand pounds to 40,000 pounds—but it did not increase its axle weight allowance, which automatically holds gross weight below 40,000 pounds with standard vehicles.

But these are only a part of the multiple hodge-podge of conflicting state laws restricting commercial vehicles, including some smelly dual fuel taxes. Arkansas and New Mexico levy a gallon tax on the amount in the tank at the border in excess of a prescribed minimum—Arkansas, 6½c per gallon, New Mexico, 5 cents per gallon. Alabama and Louisiana levy lubricating oil taxes in addition to the established federal tax. Other states permit municipal gas taxes—Alabama, up to 2 cents per gallon; Florida, Nevada, New Mexico, Wyoming, Missouri, up to 1c per gallon. Some cities (San Francisco for instance) place special local restrictions on petroleum trucks.

There is a wide variance in the different states in specifications for windshield glass, number and location of rearview mirrors, braking equipment, performance, etc.

Other Punitive Levies

There are all kinds of punitive taxes and restrictions facing these best customers of oil companies, as well as the oil companies themselves. Texas requires a motor carrier to apply to the railroad commission of that state for permission to operate on the highways, and the commission levies some pretty stiff charges. Maryland requires an insurance card on the vehicle, even though the I.C.C. regulates this. Tennessee requires payment of an inspection fee, despite I.C.C.'s rigid safety regulations. Colorado exacts a road-use fee of two mills per revenue ton-mile.

In an introduction to the booklet, company President Fruehauf, points out that, from a selfish business standpoint, its executives might logically advocate the direct opposite of what is proposed in the pages of the book. The existing situation, he says, is actually 'made to order' for a company with Fruehauf's engineering and manufacturing facilities. He emphasizes that the company's objective should its recommendations meet with success, is simply to perform real service for its customers, for the public generally, and for the nation.

The company's answer to the problem is summed up briefly in its advocacy of the establishment of full reciprocity privileges among all states. It is pointed out that many attempts have been made to put the most obvious solution into effect: the establishment of uniform vehicle size-and-weight "floors" which would be sufficiently liberal to serve the public interest.

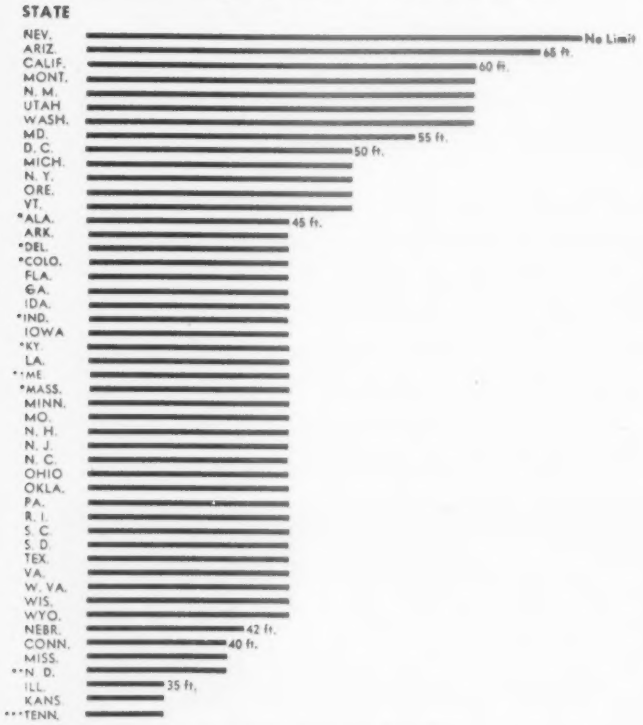
Suggests Sound 'Floor'

This would amount to increasing permissible size-and-weight allowances in states which are now too severely restrictive and standardizing all states to those same "floors". It would not mean that the more progressive states would have their size-and-weight laws cut to the uniform level, should they prefer to be more liberal. The restriction would be applied only to minimums.

The following is a typical "floor" selected for its simplicity by Fruehauf, and

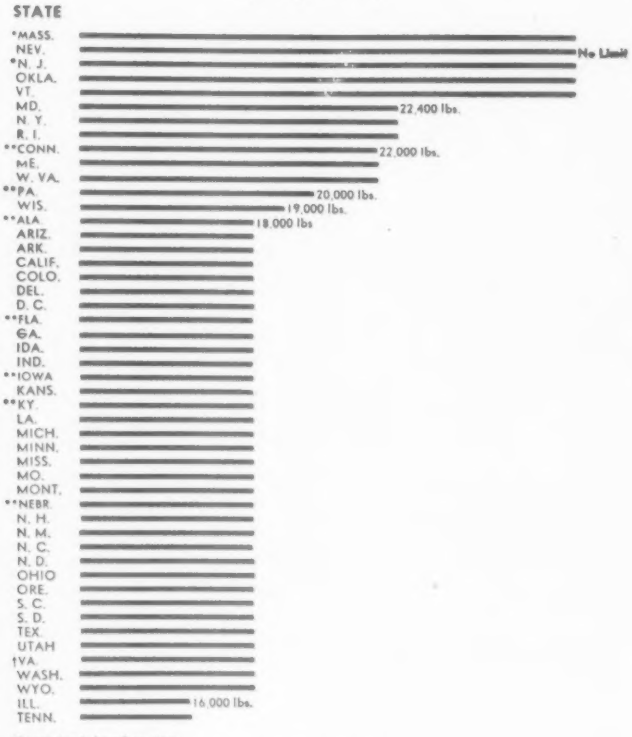
How Your State Stands on Vehicle Sizes and Weights

Maximum Length of 3-Axle Tractor-Trailer Unit



*Changed to the figure shown on a temporary war-emergency basis only.
**Permit 45 ft. for the duration when transporting petroleum products or war materials.
***Allows "over 35 ft." for duration, but no definite figure given.
†Trailer limited to 26 ft.

Maximum Weight Per Axle



*Restriction is based on tires.
**Changed to the figure shown on a temporary war time basis only.
†On certain designated highways—other highways, 16,000 lbs.

15% Capacity Increase in Petroleum Products Pipelines with the SHELL CORROSION INHIBITOR PROCESS

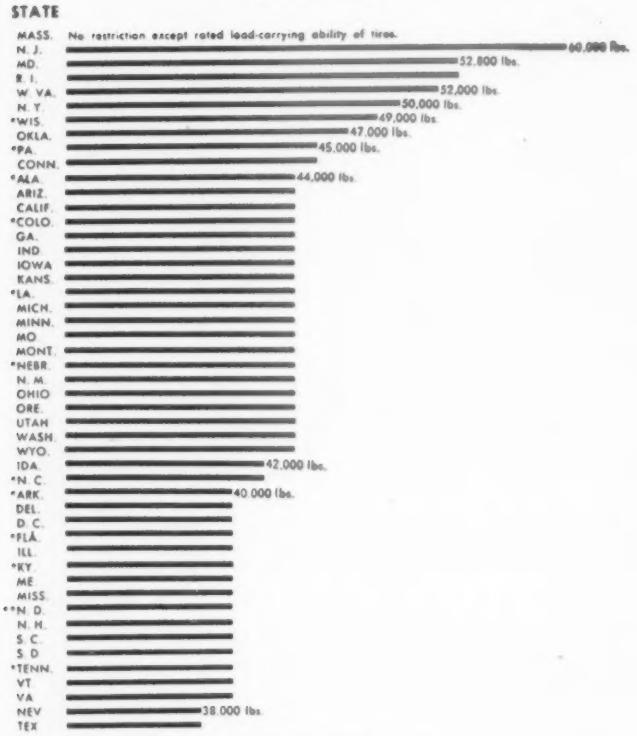
Several of the largest pipeline operators in the country are now using successfully the Shell Corrosion Inhibitor Process.

Experience has proved that this process can definitely maintain capacity increases as high as 15% without mechanical scraping.

For full details on the licensing arrangements offered, communicate with Shell Development Company, 50 West 50th Street, New York 20, N. Y.

SHELL

Maximum Practical Gross Weight Vehicle and Load



*Changed to the figure shown on a temporary war-emergency basis only.

**Vehicles carrying petroleum products or war materials permitted 44,000 pounds.

Figures shown in the graph at the left are not necessarily up to the greatest of legal allowances, due to the fact that, in some cases, other factors make it impossible to attain these legal maximums from a vehicle-design standpoint or because of superseding restrictions. This graph and those on p. 34 are taken from a pamphlet, "Are the United States United" issued by the Fruehauf Trailer Co.

for what that company terms all-around soundness:

Width of Vehicle: Body, 96 inches maximum; over dual tires, 102 inches maximum.
Height of Vehicle: 13½ feet.
Length: Single vehicle: 35 feet. Tractor-Semi-Trailer: 45 feet. All other combinations: 65 feet.
Number of Units: No restriction excepting as controlled by over-all length.

Axle Loads:

Tires	Streets	Highways	Roads
High Press.	22,500	18,000	16,000
Balloon	26,000	20,000	18,000

Gross Weight: No restriction excepting as controlled by axle limits.

(Bridge capacities are not considered in this size-and-weight "code" as it is assumed by all that bridge construction should be equivalent in strength to the highway it couples together. In the specific case where this is not true, the bridge should be posted and thereby become a police regulation responsibility.)

In view of the fact, however, that so many attempts made to bring about a uniform and more liberal "floor" such as the above have been unsuccessful, so many factors and interests being involved which serve to defeat such an objective, Fruehauf admits that an alternate answer is required. What the company terms a sound alternate solution would be the establishment of full reciprocity privileges between all states. This means briefly, it is said that a vehicle which conforms to the size and weight laws of its home state would be permitted the unrestricted use of highways in all other states regardless of the other states' size-and-weight laws.

It is pointed out that any state is well within its rights in establishing whatever vehicle size-and-weight laws it chooses for its own vehicle owners to abide by. But, warns Fruehauf, when these same laws are applied adversely to vehicles from other states they immediately interfere with interstate commerce —and this is contrary to the Constitution of the United States.

How to Attain Reciprocity

There are two ways of establishing full reciprocity between states, Fruehauf points out: by agreement between the states themselves, or by Congress. It is asserted that in the first quarter of the last century it was fully settled that the United States not only had full jurisdiction over all interstate commerce passing over the highways, but over the construction and maintenance of such highways. This jurisdiction has not always been exercised.

Regardless of who shall take the action, size-and-weight interstate trade barriers are not in the public interest and should be eliminated by the grant of full reciprocity between states, Fruehauf argues.

The answer to this by those who sponsored the present low size-and-weight limits, is: "Our highways weren't built for such loads." Fruehauf's reply is that it may be true—they weren't built for the heavier loads—but nonetheless, highways in question are fully capable of carrying these loads. The booklet then quotes the opinions of experts to support this view. Among them is a statement from the late Joseph B. Eastman when he was chairman of I.C.C., in which he said that weather and other natural forces, rather than the character and size of the motor vehicle, are responsible for nearly 75 per cent of highway maintenance costs.

Rail Shipments to East Coast Down 5376 b/d

NPN News Bureau

WASHINGTON—Tank car shipments to East Coast during week ended May 27 averaged 726,523 b/d, down 5376 b/d from previous week. Number of cars loaded was 23,590, divided among following companies:

Abercrombie	95	Elk Refining	31	Richfield	137
Allied	51	Eldorado	14	Roosevelt Oil	27
Aetna	4	Freedom Oil	5	Royal Petroleum	1
American Minerals	200	Globe	149	Shell	484
Arkansas Oil	1	Gulf	2346	Sinclair	400
Ashland Refining	139	Hartol	53	Socony-Vacuum	2925
Asiatic Petroleum	88	Hutex	10	Southland	6
Atlantic Refining	1767	Jenny Mfg. Co.	33	S.O. California	4
Aurora	33	Johnson	24	S.O. Indiana	732
James B. Berry Sons	4	Libby	3	S.O. Kentucky	32
Cantelou	12	Mid-Continent	30	S.O. New Jersey	4681
Canton	7	Mid West	31	S.O. Ohio	99
Chalmette	29	National Refining	23	Sterling	2
Cities Service	206	Ohio Oil	57	Sun	2598
Consumers	13	Old Dutch	3	Talco	81
Continental	265	Pan American	1152	Taylor Refining	43
Clymore	9	Pacific	106	Texas	2448
Cooperative G.L.S. Farm	5	Petroleum Heat & Power	11	Tide Water	1222
Cosco	10	Phillips	264	Tiona	1
Daugherty	29	Pioneer	1	Triangle	6
Deblois	4	Premier	1	United	2
Deep Rock	20	Primrose	10	Roop	55
Derby Oil	24	Pure	33	White Fuel	47
Drake	7	Republic	132	Worth	10

NOW IN PRODUCTION..

New Mack Trucks for Civilian Pool:

Because of urgent and mounting essential civilian needs, the War Production Board has authorized the manufacture of certain types of trucks for commercial use.

Assigned to Mack are models ranging from 9,000 pounds gross vehicle weight up to the largest off-highway vehicle. Production on some models has already started.

Military production continues, of course, in all Mack plants.

We will gladly give you detailed information. Just drop us a line, or phone.

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TRUCKS

FOR EVERY PURPOSE

ONE TON TO FORTY-FIVE TONS

BUY U. S. WAR BONDS

Mack Trucks, Inc., Empire State Building, New York, N. Y.
Factories at Allentown, Pa.; Plainfield, N. J.;
New Brunswick, N. J. Factory branches and dealers
in all principal cities for service and parts.

IF YOU'VE GOT A MACK, YOU'RE LUCKY...
IF YOU PLAN TO GET ONE, YOU'RE WISE!

PRODUCTION NEWS

Well Drilling Rules Eased In California by PAW

NPN News Bureau

WASHINGTON—Easing of Government controls over use of critical materials in oil well drilling in some California oil fields was announced this week by PAW. Action was taken by amending formal order (Suppl. Order No. 4 to PAO No. 11) which becomes effective June 1, 1944.

PAW Ickes said the action "is in line with PAW policy of relaxing restrictions whenever the supply of materials becomes less critical." Deputy PAW Davies said the amended order continues to give "full recognition to the fact that in many California oil fields there is a series of oil pools located vertically one under another so that the same surface area overlies several separate oil deposits."

Consideration is also given, Mr. Davies said, to the fact that many California oil sands are much thicker than those in other parts of country and that wide variation in spacing of wells is necessary to obtain maximum quantity of oil with minimum expenditure of materials.

The amended order lists about 140 fields which are affected and outlines regulations governing oil well drilling in each pool in each field. Spacing regulations governing installation of pumping and artificial lifting equipment have been eliminated, provided however, that the well where installation is to be made fails to produce its allotment by natural flow and equipment is used continually thereafter.

Hawkins Hearing Moved Up

Special to NPN

AUSTIN, Tex.—The Texas Railroad Commission has moved up an important hearing for amending the allocation hearing for the Hawkins field from Aug. 23 to June 13.

Humble Oil & Refining Co. has applied for a change in the Hawkins allocation formula to allow 40% per well and 60% for acreage.

The commission also announced the fixing of allowable production for sweet natural gas from Rodessa, Carthage and Agua Dulce oil fields. In June, Rodessa will produce 40,964,667 cubic feet daily; Carthage, 14,241,500; and Agua Dulce (Dabney Sand) 25,000,000.

Texas Notables Celebrate Santa Rita Discovery That Brought Oil Wealth to University

Special to NPN

AUSTIN, Tex.—Black gold—a wealth beside which fabled treasures of Coronado, Captain Kidd, and LaFitte the Pirate dwindle to mere small change—is educating thousands of American youth for this bright new world of ours.

At Austin, Tex., a gleaming, multi-million dollar University of Texas towers as a symbol of what oil has done toward education and progress in the biggest oil producing area in the world.

Twenty-one years ago the drill bit of Carl Cromwell broke through the crust holding back the great Permian Basin oil flood that has helped make the United States a giant in a world of big powers. The Texas Mid-Continental Oil and Gas Association thought such an occasion should not go by unnoticed, and on May 27, leaders of the state paid tribute to the remarkable discovery of oil on University of Texas lands.

Gift Called Worthless

Notables of the state, the university, and the oil profession gathered at the Driskill Hotel here for a banquet, where the story of Santa Rita, the discovery well, was reviewed by the men who know it best.

Back when Texas had just won its independence from Mexico and entered the union, 2,080,000 acres of public lands were set aside by the legislature as a trust estate for a "university of the first class" to be established at Austin.

The gift was not as benevolent as it sounds, since the land was in the wild stretches of West Texas and practically worthless. In fact, the surveying outfit sent out to survey the first million acres sent back word to the state land commissioner that the territory was not worth the cost of survey. The commissioner, however, had no choice in the matter because of the technicality that the legislature had specified the area which should belong to the University.

Today the land has enriched the University of Texas more than $35,000,000, which is still intact in the University's permanent fund.

George A. Hill, Jr., president of the Houston Oil Co. of Houston, gave the banquet some idea of what oil has meant to Texas from an educational standpoint.

"Spanish galleons, laden with gold and jewels plundered from the New World, are dwarfed into insignificance compared to oil revenues accruing to the sovereign citizens of Texas and their great educational institutions," he said.

"The total exactions of Spanish royalty and all of the prizes of the gold hunters' era was a mere triviality compared with

The University of Texas' magnificent administration building, one of the score of new structures that have entirely replaced the old wooden shacks, is symbolic of what oil money has done for education in Texas

The FIRST* process to produce catalytically cracked aviation fuel is likewise the FOREMOST**

*HOUDRY static process was first to produce catalytically cracked aviation fuel commercially—in 1937.

**HOUDRY and T.C.C. processes have supplied all but a minor percentage of the United Nations total war needs of catalytic aviation fuel. Thirty-six catalytic cracking units, employing Houdry processes, are now in operation.

HOUDRY PROCESS CORPORATION, WILMINGTON, DELAWARE

Houdry Catalytic Processes and the T.C.C. Process are available through the following licensing agents to all American refiners, subject to approval by the United States Government.

BECHTEL-McCONE-PARSONS CORP. Los Angeles, California • THE LUMMUS COMPANY New York City, New York • E. B. BADGER & SONS CO. Boston, Massachusetts

HOUDRY CATALYTIC PROCESSES ... FOR VICTORY IN WAR ... FOR PROGRESS IN PEACE

the one billion seven hundred million dollars paid during the past 21 years in oil lease rentals and royalties to farmers, ranchers and other landowners of Texas. . . .

"During this same period the petroleum industry has paid one billion three hundred and fifty million dollars in various forms of taxes to our state and local governments. During this time, the industry has paid in taxes, for the support of the public schools of this state, a grand total of over two hundred and forty-three million dollars."

Heralds New Era

Mr. Hill said that "the Santa Rita well in Reagan county was the discovery well in the great Permian Basin, and its literal eruption was the most fortuitous combination of the forces of nature and labors of man, heralding a new economic and social era in a vast and largely undeveloped domain. . . .

"The event which we are gathered here to celebrate is not the product of miraculous occurrence, royal beneficence, dictator's edit, or socialized planning. It is the natural consequence of a continuing expression of the fundamental truths that have become manifest through the ageless experience of mankind in its upward surge throughout the centuries for its most cherished aspiration—freedom."

The wealth of Santa Rita is divided, two-thirds to the University and one-third to Texas A&M. The latter military school, incidentally, has more officers in this war than West Point.

When Robert P. Ricker of Reagan County got out of the army in the last war, he was impressed by the attention oil exploring was getting at the time. He decided to try to obtain a large block of acreage from the University, but found that it would require $40,000 in fees and permits to swing the deal. Unable to raise the amount, he contacted Frank T. Pickress and Haymon Krupp of El Paso, who paid the fees, organized the Texon Oil Co., and drilled the first well.

Most Texans firmly believe that when Santa Rita blew in it was by purest accident. The legend is—and it does make a nice story—that when the driller unloaded his equipment from the railroad spur and started out to the location, the wagon broke down while only a short distance from the track. The driller, in disgust, unloaded his rig and put down his well on the spot, and the story also goes that a subsequent well on the location picked out by Geologist Hugh H. Ticker turned out to be a duster.

Story Won't Die

This story has been refuted, however, although it may never die out.

Under the legislative acts which gave the university the vast West Texas acreages, all revenue from the land has to go into a permanent fund, which cannot be spent. The university may use only the interest from the permanent fund, derived from investments in federal, state, county and municipal bonds.

It is with this interest that Texas has built the magnificent physical plant here at Austin, surpassing anything in the South with the possible exception of the richer Duke University.

The university fund, however, pyramiding from rentals and royalties, some day will be a tremendous sum. It is already over $35,000,000, and growing at the rate of around $85,000 a month. Further increases in drilling activity and a raise in the price of oil would greatly increase this amount.

Until a few years ago the university could use its oil income only for construction of "permanent improvements" —buildings. This explains the elaborate university plant.

Dr. Homer Price Rainey, university president, told the dinner guests that buildings have heretofore been the foremost need of the University "but it is not the only way we can spend our money or the only way we are likely to spend it.

Black gold gushes from a well on land owned by the University of Texas. Pressure is considerably down in the area now, and gushers such as this one, photographed in 1925, are infrequent occurrences

"Staff Second to None"

"It is unbecoming that we should have the reputation of the newly-rich who build fine houses and buy fine clothes without any regard to self-improvement in the fields of culture and enlightenment. . . .

"As custodians of the great wealth for use in the field of education, we shall be true to our trust only when we make it possible for our young people to have at Texas University the equipment and the administrative, instructional and research staffs second to none in the world. . . .

"May the spirit of Santa Rita make it possible for us to pursue the task with the same determination that characterized the discovery and development of our West Texas oil lands."

Dr. E. C. Barker of Austin, University Professor of History and representative of the Texas State Historical Association, deplored the lack of detailed information on such historically vital happenings in the business world as Santa Rita.

"From the historian's point of view, business men—and particularly business organizations—are too reticent. We suspect that they are too reticent for their own good.

"The blankest page in Texas history today is that which ought to tell of the growth and contribution of business and industry in the building of the state. The page is blank, not because historians do not appreciate the importance of the subject, but because they can rarely learn enough of the record to enable them to put pen to paper and write."

The banquet was preceded by a statewide radio broadcast, headed by Gov. Coke Stevenson, who reviewed briefly Santa Rita's history.

Stevenson noted that "individual enterprise" made possible the discovery of the University's oil store—"freedom of opportunity unfettered by needless regulation and regimentation."

Mrs. Carl Cromwell of Garland, Texas, widow of the driller who found Santa Rita, was the guest of honor at the banquet. Railroad Commissioner Beauford Jester, former University regent, was toastmaster.

Reports Steady 1944 Rise in Texas Gasoline Sales

Special to NPN

AUSTIN, Tex.—Gasoline sales are increasing rapidly in Texas, according to figures compiled by the University of Texas Bureau of Business Research.

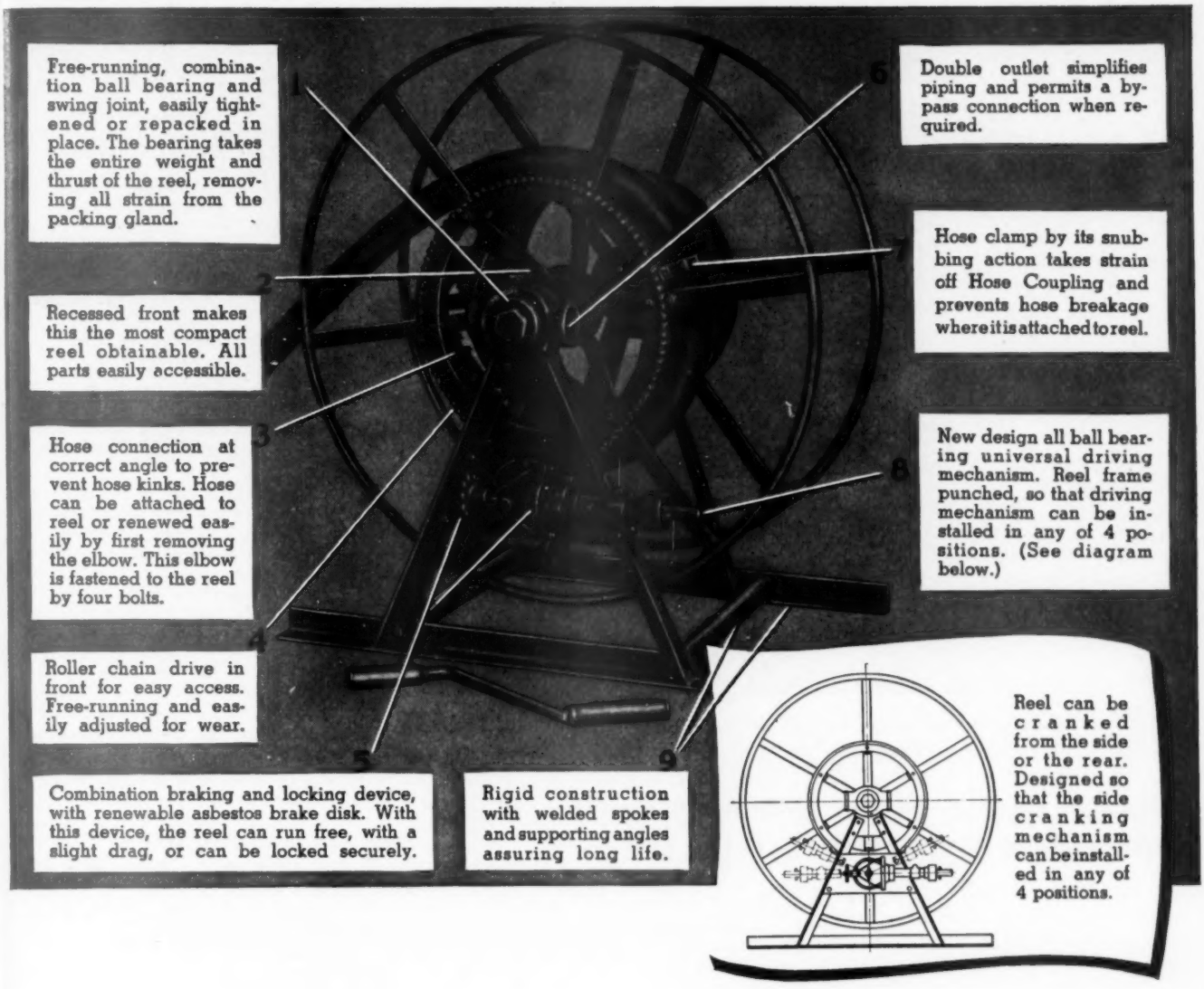
Records just compiled for March show that Texas gasoline sales increased more than 6,000,000 barrels over the same month for the preceding year, to a total of 109,789,390 barrels. In February, 1944, sales amounted to 90,577,742 gallons.

(By way of explanation, the federal government uses more gasoline than all other consumers. Much of this is taken up by the many airfields in the state).

The university report also showed that in April, Texas produced better than 43 per cent of the nation's crude, withdrawing 1,898,600 barrels daily from its reservoirs. This was some 30,000 barrels ahead of the March output but more than 500,000 barrels daily over April, 1943. West Texas showed the greatest gain.

Austin B. Scott Dies

SAN ANTONIO, Tex.—Funeral services were held here May 30 for Austin B. Scott, 38, district superintendent of sales for The Texas Co. Burial was in Waco. Mr. Scott was the son of the late W. B. Scott, one-time president of the Southern Pacific Railroad.


1
Free-running, combination ball bearing and swing joint, easily tightened or repacked in place. The bearing takes the entire weight and thrust of the reel, removing all strain from the packing gland.
2
Recessed front makes this the most compact reel obtainable. All parts easily accessible.
3
Hose connection at correct angle to prevent hose kinks. Hose can be attached to reel or renewed easily by first removing the elbow. This elbow is fastened to the reel by four bolts.
4
Roller chain drive in front for easy access. Free-running and easily adjusted for wear.
5
Combination braking and locking device, with renewable asbestos brake disk. With this device, the reel can run free, with a slight drag, or can be locked securely.
9
Rigid construction with welded spokes and supporting angles assuring long life.
6
Double outlet simplifies piping and permits a by-pass connection when required.
Hose clamp by its snubbing action takes strain off Hose Coupling and prevents hose breakage where it is attached to reel.
8
New design all ball bearing universal driving mechanism. Reel frame punched, so that driving mechanism can be installed in any of 4 positions. (See diagram below.)
Reel can be cranked from the side or the rear. Designed so that the side cranking mechanism can be installed in any of 4 positions.

The New Hose Reel You Have Been Looking For

COMPACT, RUGGED, LIGHT IN WEIGHT, BALL BEARING CONSTRUCTION THROUGHOUT

The new Philadelphia Valve Co. reel is the finest reel built. It is compact, rugged, and light in weight. All parts are of steel, malleable iron, or bronze; no cast iron is used. It is ball bearing throughout with hardened and ground races. (6 ball bearings are used.) It will never wear out.

The reel can be changed from top winding to bottom winding by reversing the hose connection and rotating the drum. All working parts and hose connections are in front and easily accessible. It is light in weight, a reel that holds 100 feet of 1½" hose, only weighs 93 pounds.

We can furnish hose reels in any size or shape. They can be furnished for installation either in bucket box at rear of truck or in underslung box on side of truck. Give inside dimensions of box when writing for information. Special reels can also be furnished for Airfield Refueling Pits and Ship Docks.

Delivery can generally be made in a few days after receipt of order. For sizes, prices, and dimensions, write for Catalogue No. 165.

PHILADELPHIA VALVE COMPANY

ARAMINGO AVENUE AND ONTARIO STREET, PHILADELPHIA 34, PA.

Pacific Coast Distributor: Oil Marketing Equipment Co., 325 Fremont St., San Francisco, Cal.

Friendly Neighbor Still directs the work of his two helpers, Manuel McClain, left, and Curtis Kemp, known as "Hold-tight"

Atlanta Dealer Finds Famed 'Worrying Rock' Still Potent Attraction for Customers

Special to NPN

ATLANTA—L. R. Still, whose small community-size filling station on the corner of McLendon and Page Ave., in Atlanta, is doing more business than ever before, in spite of the war, is "Still your friendly neighbor" to scores of families in the community. Ever since he's been in business, Mr. Still has been smiling in customers with his broad, friendly grin, and he didn't let the war stop him. When gasoline rationing got pretty tight, he changed the sign on his nationally famous back-scratching post to read "itching for gasoline" instead of "itching for business", and hauled out his "worrying rock" and shared it with his customers.

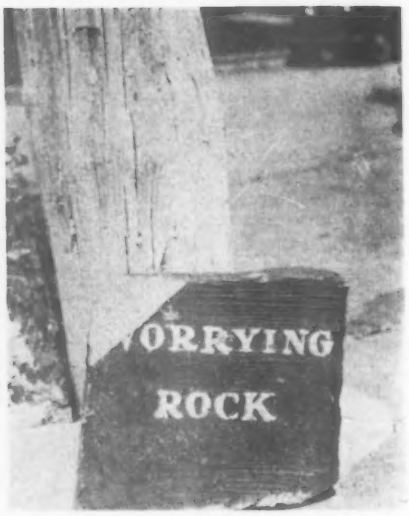
Mr. Still's "worrying rock" was a part of his business long before he thought of the back-scratching post, but it was a personal thing. Three months after he'd bought his station, he found he was gradually slipping in the hole. Instead of piping profits in, the gas lines seemed to be piping them out. It was about that time that Mr. Still heard about the unique punishment administered to minor criminals in one of Atlanta's suburbs, where, for instance, Negroes accused of having whisky in their possession were made to sit on a rock while passersby worried them by throwing coins which the Negroes could not obtain because they were forbidden to leave the rock. Mr. Still figured that if anybody needed a "worrying rock", he did. He found a granite stone, large enough to sit on, painted "worrying rock" across the front of it, and placed it beside the door of the station. Now, whenever he had some worrying to do, he had a place to do it.

He'd done a lot of worrying (though you'd never believe it because he's constantly smiling); but none of it brought such good results as the worrying he's done since he acquired the rock. For one thing, the rock induced his customers to help him with his worrying; and naturally this diminished the amount of worrying Mr. Still himself had to do.

Looking to the Future

But Mr. Still didn't actually place his "worrying rock" at the complete disposal of his customers until the war began and he started itching for gasoline instead of business. Then he gave the rock a new coat of dark blue paint, blazoned its name across its face in bright gold letters, and placed it in a more conspicuous place. He encourages prewar customers who have sold their cars and don't have the lack of gasoline coupons to worry about to use the rock as a place to sit while they wait for streetcars to take them to their jobs. Someday, he says, they'll own cars again, and where'll they go to buy their gasoline? If he can keep them sitting on his "worrying rock" until the war's over, he thinks they'll buy from him.

Only one difficulty has presented itself in keeping the "worrying rock" available. Apparently some of the students



The worrying rock is placed conveniently at the end of the station driveway. Customers may use it as a place to rest —or worry—while they wait for streetcars or for Mr. Still's mechanics to grease their automobiles

out at Georgia Tech also had a lot of worrying to do a while back, and having heard of the "worrying rock's" efficacy in such matters, "borrowed" it one night. Mr. Still advertised and followed up every clue, until he located the rock and restored it to its rightful place beside his filling station door. The students had broken off a corner of the rock which Mr. Still never recovered. Perhaps this will help them to pass their finals this spring, or perhaps, as Mr. Still hopes, it will induce them to drive into his station someday to buy gasoline.

In the meantime, he's so busy he can hardly keep up with himself. Customers in and out all day—mostly women. They'll leave their cars to be greased perhaps. In the greasing operation, Mr. Still's Negro mechanic, Manuel, may find some small part that needs replacing, or brakes that need adjusting. He reports

Mr. Still works on a customer's tire near the scratching post

Photo courtesy Allied Van Lines, Inc., Chicago

A 100% Pay Load is a truck full of products . . . AND TRUCK SPACE FULL OF ADVERTISING!

DECORATE YOUR TRUCKS WITH

MEYERCORD DECALS !

Empty trucks roll at a loss. So do "empty" or weather-worn truck panels. Decorate them with Meyercord Truck Decals . . . and deliver a 100% pay load of colorful sales impressions daily. Meyercord Decals are economical for a dozen trucks or a thousand. They are washable and weather-tested for durability. Any design, in any size or number of colors, can be reproduced . . . at a fraction of hand-painting costs. Fast, overnight application saves labor, money and idle truck time. Give your trucks that extra smartness of appearance and gain more advertising value on your "free" panel space . . . with Meyercord Truck Decals. Free design service. Address Department 36-6.

Buy War Bonds . . . and Keep Them!

Truck Visualizer — FREE!

Contains helpful hints on lettering, decorating; with outline diagrams for experimental designing of many body types — from panel deliveries to vans and tank trucks. Includes valuable data for maximum use of advertising space on all areas of trucks. Cash in on the free advertising space of your "traveling billboards."

Send for free copy TODAY!

THE MEYERCORD CO.

World's Largest Manufacturer of Decalcomania

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this to Mr. Still, and Mr. Still frequently tells him to go ahead and fix the thing, for that's what he'd want done if it were his car, he says. The women usually thank him and pay the extra charge cheerfully. Of course, you have to know your customers pretty well to be able to put this over, but knowing his customers is Mr. Still's specialty. Treating the other fellow as you'd like to be treated yourself is his motto. It was, in fact, the "you scratch my back and I'll scratch yours" idea that prompted him to erect his back-scratching post, with serrations for men, ladies, children, and dogs, in 1941. He wanted to show his customers that he was willing to do his part of the back scratching if they'd do theirs, and he thinks they have.

Another extra service that Mr. Still offers now is vulcanizing. He's teaching "Hold-tight," his negro porter, who has practically been brought up at the station, to help him with this work. He's already more than paid for the small vulcanizing machine he had to buy, he says.

While he hangs on to his former customers who no longer own cars by means of his "worrying rock", and servicemen's wives by means of little extra attentions, Mr. Still is hanging onto the servicemen themselves by a friendly gesture that has become very popular in the neighborhood. He has a very large V-shaped placard in his display window, and on this placard he has pasted snapshots of nearly all the boys in the community who've gone into the Army, Navy, Marines, or what have you. If somebody's husband or son isn't on the placard, it's because Mr. Still hasn't been able to get a picture of them. These boys will be among his best customers when they come back from winning the war, Mr. Still thinks.

Gardener In Spare Time

In his spare time, Mr. Still is a gardener. Part of his garden is behind the filling station, and part of it is in his backyard at home. He grows prize tomatoes and other vegetables "just to show people I can", he says, and beautiful flowers "because I like to give them away". His dog, Beetle, is almost as popular around the station as Mr. Still himself. Her bag of tricks includes a snarling, scratching act when asked what she'd like to do to Hitler. This act complements Mr. Still's own sign above the door which reads "We WASN'T mad at anybody". Beetle's "ever ready quintuplets" last year were also very popular—so popular, in fact, that Mr. Still gave them away to some of his customers.

Mr. Still, however, doesn't spend all his time dreaming up ideas to expand his own business by putting reciprocity into practice. He's president of the Georgia Assn. of Petroleum Retailers, elected in 1942 for the duration of the war. In addition, he's a member of the Eastern States Gasoline Dealers Assn. and is the Georgia representative on the Petroleum Marketing Sub-committee.

Financial Reports

Phillips' Dividend Record

Special to NPN

BARTLESVILLE, Okla. — Gross income of $44,239,326.60 for the first three months of 1944 was the highest for any quarterly period in the history of the Phillips Petroleum Co. Net income, after all charges, reserves and taxes, was $3,713,011, or 76 cents a share on 4,916,987 shares outstanding. This compares with $3,597,334, or 80 cents a share on 4,492,980 shares outstanding in the first quarter of 1943.

Honolulu Corp. Shows Increase

Special to NPN

SAN FRANCISCO—The gross operating income of the Honolulu Oil Corp. and subsidiary companies in 1943 increased $2,196,173, to $7,993,391, and the net income after deducting taxes, including estimated federal income tax, was $2,844,292, an increase of $1,251,817. The net income per share of capital stock after all charges, including estimated federal taxes, was $3.03, an increase of $1.33 per share over the previous year.

Sinclair Earnings $23,083,709

NPN News Bureau

NEW YORK—Net 1943 earnings of the Sinclair Oil Corp. and subsidiaries amounted to $23,083,709, or $1.85 per common share on the shares outstanding at the close of the year.

La. Company's Profits Increase

Special to NPN

HOUMA, La.—The Louisiana Land and Exploration Co. announced a net 1943 profit of $1,800,293, or 60 cents per share, which compares with a net profit of $1,100,023, or 37 cents per share, for 1942.

Argo 1943 Profits $431,157

Special to NPN

DENVER—Net profits of $431,157, amounting to 63.10 cents per share, have been announced by the Argo Oil Corp. for 1943. This compares with net earnings of $376,292, or 54.37 cents per share, for 1942.

Imperial Net Up Slightly

Special to NPN

OTTAWA, Can.—Net earnings of Imperial Oil Ltd., in 1943 were equivalent to 57.66 cents a share, as against 54.38 cents a share in 1942. Of the 1943 earnings 34.72 cents a share was from Canadian operations exclusive of Canadian producing subsidiaries, the remainder being from subsidiaries, mainly dividends paid by International Petroleum. Undistributed profits from subsidiaries amounted to 4.58 cents a share, thus making all-inclusive net earnings equivalent to 62.4 cents a share.

British American Profits Up

Special to NPN

OTTAWA, Can. — Net profit, after all charges, of the British American Oil Co., Ltd., in Canada in the year 1943 was at the rate of $1.06 a share on the common stock, as compared with $1.03 in 1942. Absolute dollar net profit was $2,946,014. Taxes were $2,204,097, and $2,601,262 was set aside for depreciation. Sales were at an all-time high.

Plymouth Pays $2 Per Share

Special to NPN

PITTSBURGH — The Plymouth Oil Co.'s consolidated net earnings for 1943, after depreciation, depletion and federal income tax, were $2,237,597, equivalent to $2.16 per share on 1,037,216 shares. This compares with net earnings of $1,774,145, equivalent to $1.69 per share.

Declares Semi-Annual Dividend

NPN News Bureau

NEW YORK — Standard Oil of New Jersey last week declared a regular semi-annual dividend of 50 cents per share and an extra 75 cents per share dividend payable to stockholders at the close of the business day on May 15.

Can Co. To Operate in Mexico

NPN News Bureau

NEW YORK—Continental Can Co., will shortly extend its interests to include Mexico, according to an announcement by Carle C. Conway, president. This will be accomplished through a Mexican corporation, which will soon commence the erection of a modern can manufacturing plant in Mexico, D. F., to be equipped with the latest automatic can manufacturing machinery, the announcement stated.

Hughes Co. To Expand Plant

Special to NPN

HOUSTON — An expansion program to cost $3,500,000 has been inaugurated by Hughes Tool Co. at its Houston plant, M. E. Boehm, vice president and general manager, has announced. Contract for building improvements costing $1,700,000 has been awarded and an additional $1,800,000 will be spent for new equipment.

Letter from Reader

Likes Our Stand on Co-ops

FROM: H. A. Mayor, President, Southwest Grease & Oil Co., Wichita, Kans. TO: The Editor.

Congratulations on your editor's page of May 17 and the liberal space allowed N.T.E.A. on May 3.

We really appreciate your stand on this matter.

'24 to '44

20 Years of Unquestioned Quality Enjoyed by Sellers and Users of 100% Pure Pennsylvania Motor Oils

Since the emblem of the Pennsylvania Grade Crude Oil Association first came into being—in 1924—it has been the oil-mark of top quality lubrication. The emblem has been widely advertised, too, but all the power of advertising can't sell poor oil to the same man twice. Emblem Pennsylvania Oils have been steady repeat-sellers — winning friends and holding them—simply because their *performance* has fulfilled every advertisement we ever published.

The quality of 100% Pure Pennsylvania Motor Oil—as every oil man knows—stems from the crude oil from which they're made—Pennsylvania Grade Crude. From this better raw material, a better finished product is a natural result because Pennsylvania refiners, of course, keep always abreast of proved refining advancements.

You are always sure of Pennsylvania quality, and that is a big reason why motor oils entitled to our emblem should be an important factor in your business today...

AND A VITAL FACTOR IN YOUR POST-WAR TOMORROW.

Inquiries invited.

PENNSYLVANIA GRADE CRUDE OIL ASSOCIATION

OIL CITY, PENNSYLVANIA

Because of its high quality, war demands great quantities of 100% Pure Pennsylvania Motor Oils and this demand comes first, of course. Our region is producing and refining to the limit. Our oils are still available most everywhere for essential motoring needs.

Drafting of Young Technicians Among Topics At PAW Manpower Conference in Capital

NPN News Bureau

WASHINGTON — A PAW selective service-manpower conference, attended by the various PAW district manpower committee chairmen, was held here recently to discuss the impact of drafting of workers between ages of 18 and 25 under the inter-agency deferment plan, the probable effect of withdrawals in the 26-to-29 age group, and general problems of recruitment, staffing, and manpower priorities. The conference was called by the labor counselor's office of PAW.

Frank discussions with Selective Service and WMC officials cleared away a considerable number of questions in the minds of industry representatives, it was reported. Most significantly, the industry pointed out qualitatively and quantitatively the effects upon the production of crude oil and aviation fuels and lubricants of the withdrawal of technically trained men in the youngest age group. It was clearly indicated that industry will be able to scrape by with its present holdings but that further withdrawals will lead to measurable losses in production.

Discussions concerning possible losses in the age group 26-29 furnished abundant proof that protection to substantially all classes of skills and semi-skills is a vital requirement if the industry is to meet its crude oil production goals and its vital product program. The industry is expected to furnish statistical particulars outlining the specific effects of the withdrawal of skilled and semi-skilled workers in this age group.

One of the principal highlights of the meeting was a clear undercurrent of feeling that within the next few months recruiting and staffing problems likely will veer sharply in the direction of crude oil production, drilling, and exploration.

Four Plans in Operation

Four separate but parallel staffing plans are presently in operation in Dists. 2, 3, and 5. Industry representatives discussed in detail the controlling factors underlying the principles of these plans. In all cases it was apparent from the meeting that the extent to which the staffing plans were being used depended almost entirely upon (1) the WMC controls in effect in particular districts, and (2) the actual labor shortages experienced either in localities within districts or within the district as a whole.

The California plan which services all branches of the industry operates under WPB production urgencies and WMC manpower priorities, and under company controlled referral conditions. The industry has established a central managerial office as a contact between individual companies and the petroleum administration representatives on the Production Urgency Committee and Manpower Priority Committees. Once urgencies and priorities are established for particular concerns, including the establishment of manpower ceilings which limit the total employment for any particular period of time, hired recruiters in strategic USES offices make referrals directly to concerns indicating current needs for labor.

It was suggested by the Dist. 5 industry representative that the recruiting agents may soon be given power to hire for individual companies at the point of referral. This possibility is based upon the fact that considerable losses between the point of referral and the hiring gates have been experienced.

Industry Favors Possibilities

In Dist. 3 the new production recruiting and staffing plan was reported in considerable detail by Ray Horton, who in addition to being vice chairman of the manpower subcommittee is manager of the recruitment plan. This plan has been in operation for about a month and sufficient data have not been accumulated to be able to judge the overall effectiveness of the plan.

It was reported, however, that industry looks with favor upon its possibilities. This plan operates upon a principle of a paid manager of recruiting directing the activities of non-paid industry liaison representatives located in strategic producing and drilling areas in PAW Dist. 3. Each of the industry agents working in close contact with local and area USES offices attempts to fill industry requirements by interviewing and recruiting likely applicants for such concerns. Should the area agent fail either to locate recruits or to effect their placement, the central office takes over in co-operation with area and regional USES offices effecting inter-area, and if necessary, inter-regional recruiting plans. This plan has the important advantage of making it possible for the hundreds of small producers and independent drilling contractors to get the full advantage of recruiting facilities at both the industry and the USES.

Dist. 3 refining recruiting is based upon the same principle as the production recruiting plan except that there is no central managerial office. This plan has been in operation since Nov., 1943, and while reports have not been completed, known hires resulting either directly or indirectly from the plan exceed 4000.

Dist. 2 recruiting plans, while following the same principle as Dist. 3 programs, have not been required on a region-wide scale. Dist. 2, covering as many states as it does, runs across labor market situations varying from areas

Explain Operation of Gas Turbine at Tulsa Meeting

Captain L. F. Small (left), chief procurement officer of the Bureau of Ships for the Navy, and J. K. Salisbury, of General Electric's turbine engineering division, are shown discussing a scale model of a 3000 hp continuous combustion "gas" turbine built by G.E. for the study of application in ship propulsion. Both men recently indicated enthusiasm for the future of the gas turbine in addresses before the A.S.M.E. Oil and Gas Power Division at Tulsa

of great labor scarcity to areas in which there is an excess of manpower. Moreover, the concentration in the industry is extremely thin except in areas such as Cleveland, Toledo, Chicago, and Tulsa. Accordingly, the plan has been used, more as a trouble-finding device and local area recruiting plan than as a unitized device. Principal trouble spots to date have been the Calumet area and the Cleveland and Toledo areas. Present activities include the arrangement of inter-regional recruiting plans for certain companies in the Calumet region and in several Ohio areas.

In the event substantial withdrawals are required in the lower skilled levels of the age bracket 26 through 29 each of these plans may be improved in directions indicated by the War Manpower Commission as leading to more referrals. The principal advantage of the four separate systems is that each is flexible and may take on or throw off recruiting devices as they are tested elsewhere.

PAW has prepared a comprehensive brochure outlining in detail present Selective Service Administrative rules and regulations and War Manpower Commission area stabilization programs. Specific and detailed information concerning the use of staffing plans and suggestions leading to the preparation of improved 42A forms are included. The Petroleum Industry War Council has agreed to publish this brochure for the benefit of the industry soon.

It was stressed by PAW that the responsibility for staffing and recruiting must be in the hands of industry and that PAW was able to assist in these programs to the extent of securing labor priorities and inter-area and inter-regional recruiting permits.

Other problems discussed at the meeting included the use of women in the industry, War Labor Board cases, and the present uselessness of both manning tables and replacement schedules.

Speakers included Lieut. Col. Bayard S. Shumate of the National Selective Service System, Dr. William Haber, of the War Manpower Commission, and Stewart P. Coleman, director of PAW program division.

Attending from industry were W. C. Lynch, acting chairman, Manpower Committee of the General Committee, PAW Dist. 5; Ray Horton, Vice Chairman, Manpower Subcommittee of the Production Committee; K. R. Dailey, chairman, Manpower Subcommittee of the Refining Committee, PAW Dist. 3; Dr. O. E. Bransky, vice chairman, Manpower Subcommittee of Refining Committee; John D. King, secretary, Refining Committee, PAW Dist. 2; and George H. Dempster, chairman, PIWC Manpower Subcommittee; PAW Dist. 1. PAW was represented by the Labor counselor's office and sections chiefs of the manpower sections of the PAW operating divisions. Raymond W. Varnum, recently appointed PAW labor consultant from Dist. 5 accompanied Mr. Lynch from California.

A *Symbol* OF PROVEN *Rugged* RELIABILITY

Long respected for the quality it represents, the familiar trade-mark of the Milwaukee Valve Company today stands as an emblem of endurance and efficiency—a mark of merit that signifies the very best in valves and fittings for the oil industry.

This trade-mark represents many years of practical experience in the manufacture of precision valves which has resulted in many new and important improvements in valve design and construction. The operating efficiency, strength and life of Milvaco products has thereby been increased which assures peak performance and economy in service under the most rugged conditions.

The ready acceptance of Milvaco valves by the Army and Navy is a fitting tribute to their unfailing dependability.

And because the demands of war have stepped up the tempo of our production processes, we are now able to keep pace with our war contracts and still provide a substantial volume for domestic needs — thus permitting us to take care of your more urgent requirements.

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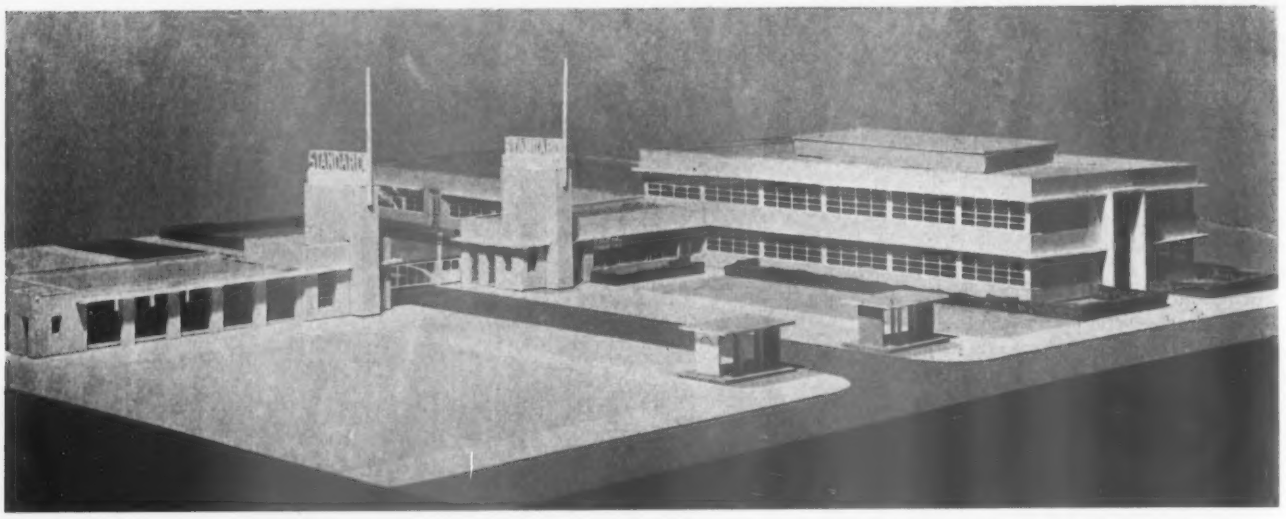
Louisiana Standard Building Personnel and Medical Building



Here's a scale model of Louisiana Standard's proposed personnel and medical building

Ground layout work has been started on the new Personnel and Medical building of the Standard Oil Co. of Louisiana at the Refinery's main entrance on the Scenic Highway near Istrouma.

A combination one and two-story building will form the main part of the structure, which will have large dimensions. The several departments of personnel and medical divisions, as well as the main office of the timekeeping and recording department will be housed in the buildings.

The company will build a clock house and sales room for employes on one side of the pylons which are to border the entrance, while a police house and customs office will be placed on the opposite side. These, too, are part of the general building plan.

Plans are under way to remove at once the frame buildings which now occupy the site of the new project in order to permit the work to go forward without delay.

W. P. Reymond, Jr., personnel manager, his several personnel assistants, and the offices of the Safety and Training Departments, in charge of A. J. Ferguson and T. S. Keaty, respectively, will occupy the upstairs portion of the building, which fronts on the Scenic Highway.

A large assembly hall and several conference and training rooms, as well as offices for department assistants and clerical personnel will be placed on the same floor.

Connecting upper and lower floors of the Personnel building will be a wide, curved stairway. On the ground floor level, at the front of the building, will be housed the employment and annuities and benefits departments, while at the rear, the timekeepers and the identification and rationing personnel will be placed.

W. W. Weldon, assistant personnel manager, heads up the employment group, B. H. Farrier, the annuities and benefits group, B. F. Anderson, the identification and rationing group, and S. V. Arbour, the timekeeping and recording group.

The greater portion of the ground floor part of the personnel building will be occupied by the employment department. This section is to contain interview and testing rooms, in addition to large waiting rooms for white and Negro applicants.

The one-story portion of the Personnel and Medical building will be occupied by the medical department, of which Dr. C. E. Allen is director. In this same building will be housed the offices of several physicians, consultation room, ward and treatment rooms, X-ray and physiotherapy rooms, laboratory and clerical offices, waiting rooms, and other facilities. The ambulance entrance will be on the south side of the building within the refinery gate.

Plans call for cast stone construction, concrete walls, or footings, terra cotta, gypsum block, and wood and glass partitions. The main building will be approximately 250 feet long by 70 feet wide by 26 feet high in the two story section. The police and customs building will be 65 feet by 20 feet, and the clock and sales building 90 feet by 33 feet, maximum calculations.

Tulsa Firm Gets 'E' for Its Pumps on War Pipelines

NPN News Bureau

TULSA — In a ceremony held here last month Gaso Pump & Burner Mfg. Co., manufacturers of oil field pumps and equipment, received the Army-Navy "E" award for outstanding performance in production of pumps for portable pipelines used by the Army.

Col. H. A. Montgomery, executive officer, supply division, Office of the Chief of Engineers, Washington, in presenting the "E" award pennant praised the employes "who have done an American job in a typical American manner." He warned: "There must be no slackening of effort . . . the hardest fighting is yet to come and by the same token the heaviest demands on the production front are still ahead." H. F. Stover, secretary-treasurer of the company, accepted the flag.

Sergt. William L. McKim, veteran of the Tunisian, Sicilian and Italian campaigns, presented the first "E" pin to Ralph Roof, representing the employes.

Gaso was founded in 1916 by T. J. Flanagan and M. J. Flanagan, president and vice-president, respectively.

Bailey Chairman of Meter Co.

NPN News Bureau

CLEVELAND—At a recent organization meeting, directors of the Bailey Meter Co. elected E. G. Bailey chairman. Mr. Bailey, former president and founder of the company, is succeeded as president by Robert S. Coffin, vice-president of the company since 1925.

New Rayon Cord Plant Planned For Synthetic Tires

NPN News Bureau

NEW YORK—Construction of a new plant at Scottsville, Va., part of the government's program to supply more rayon cord needed in the manufacture of synthetic rubber truck and bus tires, will begin soon, it was recently announced here by Herbert E. Smith, president of United States Rubber Co.

When completed, the plant will produce 12,000,000 lbs. of twisted rayon tire cord annually, which is enough to build 600,000 medium-sized synthetic rubber truck tires, declared Mr. Smith.

Estimated cost of the project, including land, building and machinery is $2,240,000 and will be financed by the Defense Plant Corp.

Canada Mines Minister Draws Criticism on Tar Sand Experiments

Special to NPN

OTTAWA—The Dominion Government, through T. A. Crerar, Minister of Mines and Resources, has announced it expects to spend $145,000 over the next year in completing experiments for extraction of petroleum from the tar sands of northern Alberta. The experimental plant is to have a capacity for handling about 600 tons each 24-hour operational day. It is expected the separation plant at Waterways, Alta. will be in operation in a few days, and the refinery, about Sept. 1.

Mr. Crerar said a great deal of information had yet to be obtained before it can be concluded that the tar sands project is capable of successful commercial operation.

J. R. MacNicol, member of Parliament for Toronto-Davenport, criticized the government's effort at development as costly and inefficient. He said Abasand, Ltd. under Mr. Max Ball, should have been left in charge of the plant it had initiated but that Mr. Ball had been "forced out". The Abasand interests, he said, were the only ones who knew how to extract oil from these sands. Some Government official had ordered that the company's plant be torn down and rebuilt in the pit to do away with hauling the sand to the surface, only to find later that the plant would be flooded. The plant was again torn down and rebuilt on the surface. Public money had been wasted and a parliamentary committee should investigate "this comedy of errors," he added.

No Criticism of Abasand

Mr. Crerar said there was no criticism of the Abasand process for extracting oil from the sands. Crude oil produced by the Abasand plant in 1941 was 20,282 barrels, and in 1942 it was 9958 barrels. None was produced in 1943. The tar sands under practical experiment on the roads of Alberta had been proved of value as a paving material and had stood the test of time.

Mr. Fallow, a minister of the Alberta Provincial Government, has also lately severely criticized the Dominion Government's handling of the tar sands experimental plant, using the terms "incompetence" and "sabotage" in his remarks.

Mr. Crerar said tar sand samples had been submitted to Universal Oil Refineries of Chicago for analysis. They had estimated the sands would yield—

1—22% in volume in aviation gasoline of 100-octane

2—17% in volume in motor fuel of 73-74 octane

3—16½% in volume of cheaper fuel oils

They had also estimated the cost of a refinery capable of handling 5000 barrels of bitumen a day at approximately $8,700,000 in U. S. funds.

DOUBLE BEARING CONSTRUCTION

CAPACITIES 35 - 50 - 90 GPM

- **SELF - ADJUSTING FOR WEAR.** Due to Blackmer Bucket Design (swinging vane principle).
- **DOUBLE BEARINGS.** The bearings are on both sides of the rotor. This construction insures the utmost in shaft rigidity, thereby eliminating vibration and subsequent wear.
- **RELIEF VALVE.** This vital part of a Blackmer truck pump is quiet, chatter-proof in operation and will bypass entire pump capacity without shock or end-thrust on the working part.
- **COMPACT DESIGN.** Requires small mounting space. Fits all sizes of truck chassis.
- **PRICE.** Lower than you might expect.

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Investigate it NOW

OTHER UNITS IN THE BLACKMER LINE

POWER PUMPS	HAND PUMPS
1 to 750 GPM—	1½ to 25 GPM—
Pressures to 300 psi.	Pressures to 125 psi.

Write for Bulletin No. 102

BLACKMER PUMP COMPANY, 1886 Century Avenue, Grand Rapids 9, Michigan

SERVING THE PETROLEUM INDUSTRY FOR 40 YEARS

COMPLIANCE SERVICE ON WAR OIL RE

Amendment 21 to RO 5C At Last Provides Method To Obtain Adjustment of Legitimate Shortages

Have you received one of those letters from OPA which starts out "In accordance with our announced procedure, we are today requesting the ..... bank to debit your gasoline ration banking account" etc.? That's getting to be standard procedure. The form is from the usual letter sent to supplying oil companies; at the same time letters are sent to the offending station, to the local ration board and to the bank.

Mr. Hadlick

This is the technique now for getting rid of improperly endorsed, counterfeit and other unacceptable coupons. It is the kind of practice which is objected to by every operator who gets such a letter. It is the kind of thing which trade associations are being asked to use their influence to stop.

Any operator who asks his trade association to stop such a practice is placing a large order. There is no ground for asking OPA to close its eyes to the willful and deliberate acceptance of coupons in violation of the rules. There is however a great deal of room for fairness in the procedure, and there shouldn't be too much need for OPA to issue a great many of the kind of letters above referred to. The job of rationing is one that cannot be done alone by OPA; it is one which requires co-operation and hard work on the part of many persons in the petroleum industry. That co-operation will exist only so long as OPA officials introduce a large measure of toleration in their actions; OPA should in addition adopt a procedure which permits explanation and adjustments of apparent errors in advance of the charge-back.

Another Phase of Problem

We believe that OPA officials should desire only that rationing regulations be observed to that reasonable degree which is used as a standard in judging other actions of human beings. We cannot believe that they should be interested in building up a large number of prosecutions, a large number of suspensions, nor even a large number of occasions for debiting gasoline ration banking accounts.

There is another phase to the matter, one which should have come out in picture-magazine form so that every person in the oil industry would be completely exposed to it. It is known in technical reference language as Amendment 121 to Ration Order 5-C. This amendment deals primarily with the situation of shortages of ration evidences where service stations change hands or are closed. Generally this amendment represents a tightening up. For the first time there is presented a set of rules by which the operator with a legitimate shortage has a recognized formula by which he may set himself right. This formula will not take care of debits as above referred to.

Ration boards all over the country have been having trouble with shortages of ration evidences at stations which closed or changed hands. Many of these closings have been for legitimate reasons such as the operator going into the service. Other closings have at least been suspicioned to be phony sales to a relative or convenient friend for the purpose of wiping out a shortage of ration evidences.

Debit balances against a dealer's ration bank account is discussed by Elwin E. Hadlick, prominent member of the Minnesota Bar and executive head of the Northwest Petroleum Assn. in this week's compliance article. He also reports on the recent amendment which permits a dealer to make an adjustment of gasoline losses which frequently occur in legitimate fashion as every oil man knows. The article is the 12th in the series.

In at least one consolidated rationing board area a workable system has been developed over the past few months by which the board has had the benefit of the advice and help of representative, experienced dealers, in considering and acting upon shortage situations. Big weakness has been that there was no compulsory or mandatory period within which reporting could be required; without a reporting requirement in the regulation local boards were powerless to institute one which could be made mandatory.

Absence of Rules a Handicap

From the operators' standpoint there was a logical and understandable reason for staying away from the board until the last possible moment. There were no rules set up and the operator feared he lacked ability to convince a hard-boiled board (if it should turn out to be that) of the logical and actual nature of his shortage. Best procedure has seemed to many to be to stay away from the board until the shortage became so great that there was no alternative except to make the application. Then in most cases the board was in a complete state of confusion as to what to do. Many board members know nothing about the oil industry, and find it extremely difficult to understand that it is impossible to operate a filling station or any other unit in the petroleum industry without shortages; they fail to realize that the fellow who really needs watching, if there is anyone who does, is the bird who hits the perfect balance between income and outgo.

Legitimate Losses Recognized

Washington has now recognized the situation to a degree. In the amendment referred to there is clarification and recognition of legitimate losses, with a setting up of procedures for handling, while at the same time there is a tightening up so as to take questionable activities outside the pale of things which will be condoned.

Boiled down the new rules for those operators who are continuing in operation but who find that their supply of ration evidences added to supply of merchandise on hand equals less than the total which they ought to have are about as follows: A dealer's gasoline and coupons must balance his storage capacity at all times, except for unavoidable shortages incurred within the preceding three months. That inaugurates a three-month report. First report is due three months after the May 13th effective date of the order, or on or before July 12; that first report can cover any losses incurred prior to May 13th; for any losses occurring after May 13th, a report is required within three months.

Inventory shortages must be corrected by reports whether caused by handling, evaporation, theft, or other unavoidable circumstances. In the same breath it is required that those dealers who find themselves with excess ration evidences on hand must make report to their local board or to an OPA investigator within three months after the overage appears.

It isn't necessary here to spend a great deal of time covering the rather complex rules relating to changing ownership, management, or control of service stations. It is sufficient to say that the rules are now set up so as to catch shady or questionable transactions. To the operator who is going to take on a location which has been in operation, the good advice is to check the rule carefully, and probably also to check with the local ration board; such procedure will keep anyone from stepping into a troublesome situation.

CODE: AO—Administrative Order; CMP—Controlled Materials Plan; D—Directive; FDO—Food Distribution Order; GMPR—General Maximum Price Regulation; GO—General Order; Interp.—Interpretation; L—Limitation Order; M—Conservation Order; MPR—Maximum Price Regulation; P—Preference Rating Order; PAO—Petroleum Administrative Order; Pri. Reg.—Priorities Regulation; Proc. Reg.—Procedural Regulation; PS—Price Schedule; RO—Ration Order; RPS—Revised Price Schedule; SO—Supplementary Order; SR—Supplementary Regulation.

Index of Week's War-Oil Orders

(Issued May 27 — June 3, 1944)

PAW—Petroleum Administration for War

PAW Directive 70, Am. 1—Supply and import allocation schedules

District 2 Supply & Transportation Director Letter to Refiners—Military take increased to 25%

OPA—Office of Price Administration

Prices

GMPR, RSR 11, Am. 50—3-24-44 base date for certain services with no specific ceiling

MPR 170, Am. 8—All anti-freeze sales brought under MPR 170's control

MPR 436, as revised 6-3-44—Crude increases for 1 Wyoming and 3 Colorado Fields

Rationing

RO 1A, Am. 77—Transfer of tires from manufacturers to dealers

RO 5C, Am. 125—Special rations for certain rebuilt trucks

Am. 128 — Gasoline purchase permits authorized for tailoring special rations of over 20 gallons

Order 5—Acceptance of R coupons in Oklahoma

Rev. RO 11, Am. 9—Summer hot water rations; renewed space heater rations

Am. 10—Period 1 coupons redeemable now; special summer rations restricted; fuel oil ration bank accounts

Administrative

Rev. Proc. Reg. 1, Am. 7—Procedure for application for price adjustment; review; protests; interpretations

WPB—War Production Board

L-197, as am. 5-27-44—New steel drums permitted for packing asphalt, lubricating greases and certain other products

L-270, as am. 5-27-44—Automotive maintenance equipment

M-137, Revocation—Benzene now allocated under M-300, Schedule 22

M-150, as am. 6-1-44—Aromatic solvents

M-221, as am. 5-29-44—Textile bag restrictions

R-1, Appendix IV, as am. 5-31-44—Tire allotment plan

SSS—Selective Service System

Local Board Memorandum 158—Replacement schedules

NWLB—National War Labor Board

GO 4, 5-27-44 am.—Wage increases for Region XII truck drivers, wholesale and retail distribution establishments, clerical workers require approval

Digest of Week's War-Oil Orders

Petroleum Administration for War

SUPPLY AND IMPORT ALLOCATION SCHEDULES—PAW Directive 70, Am. 1—Allocation of total foreign supply among foreign importers or suppliers, as well as preparation of supply schedules is to be done in a manner deemed equitable by the Director of Foreign Supply, of Foreign Refining, or of Foreign Production. Issued 5-20.

DISTRICT 2 MILITARY TAKE 25%—PAW Letter to Dist. 2 Refiners—Dist. 2 refiners must deliver 25% of total gasoline manufactured, based on average crude runs, for military use or for civilian replacement gasoline. Corrected June crude run estimates must be filed with district office by 6-1, and replacement gasoline applications must be filed at once. Issued 5-25.

Office of Price Administration

3-24-44 BASE DATE FOR CERTAIN SERVICES—GMPR, RSR 11, Am. 50—Rates for transportation of commodities by rail, water, motor, pipeline, or other conveyances, heretofore exempt from price regulation, take as a ceiling base the rate charged on 3-24-44, including increases officially granted after that date. Furnishers of such service are exempt from GMPR if these services are at rates required by law to be non-discriminatory. Issued 5-25, effective 5-23.

ALL ANTI-FREEZE SALES UNDER MPR 170—MPR 170, Am. 8—Ceilings for particular transactions not covered by MPR 170, nor by a special order under 170, such as between wholesalers, are based on ceiling for sales to retailers set by 170 or a special order thereunder. Freight absorption required of jobbers on individual shipments to retailers of Types N and S anti-freeze reduced from 5c to 3c per gal. Issued 5-29, effective 6-3.

CRUDE INCREASES FOR 1 WYOMING AND 3 COLORADO FIELDS—MPR 436, as revised 6-3-44—Moffat, Tow Creek, and Wilson Creek Fields, Colorado granted 5c per bbl. increase, making $1.25 ceiling for crude of 40° and above gravity, with 2c differential for each degree of gravity, making $1.01 ceiling for below 29°. Wyoming's Big Muddy Field 5c increase makes $1.13 ceiling for all crude, regardless of gravity. Lance Creek $1.25 ceiling applies to all sales, regardless of contracts. Dry gas ceilings may no longer be based on closest competitor's highest maximum; instead tentative ceilings must be submitted to OPA for approval. MPR 436 does not cover crude sold to a consumer or tank wagon reseller for other than refining purposes; MPR 88 governs. Crude put through a bona fide refinery process which results in production of more than one petroleum fraction becomes a "petroleum product" and no longer subject to 436. Issued 6-2, effective 6-7.

TRANSFER OF TIRES FROM MANUFACTURERS TO DEALERS—RO 1A, Am. 77—Term "dealer" includes anyone, except manufacturer, engaged in business of selling tires or tubes or who acquires them for resale, abolishing distinction between wholesaler and retailer. Manufacturers may ship new passenger tires without certificate or special authorization up to 7-15-44. Shipping memorandum must accompany all shipments, and copies must be mailed, once each week, to OPA Inventory Branch, New York. New dealers must apply to area's District Director for initial inventory, stating location of proposed place of business. Manufacturers may not transfer tires or tubes to dealers on Parts B dated earlier than 4-1-44, unless manufacturer has received such Parts B by 7-15-44. Parts B may no longer be transferred, upon district office approval, between dealers. Issued 5-25, effective 6-1.

SPECIAL RATIONS FOR REBUILT TRUCKS—RO 5C, Am. 125—Special rations permitted for operation of trucks to or between rebuilding plants, and in course of rebuilding, but not in excess of 200 miles, unless ODT certifies that alternative transportation by rail or water is unavailable or inadequate. Issued 5-29, effective 6-2.

GASOLINE PURCHASE PERMITS FOR TAILORING SPECIAL RATIONS EXCEEDING 20 GALLONS—RO 5C, Am. 128—To B and C coupon grants may be added gasoline purchase permits to supply fractions of coupon values, in tailoring special rations of over 20 gallons. Issued 6-2, effective 6-6.

ACCEPTANCE OF R COUPONS IN OKLAHOMA—RO 5C, Order 5—Licensed Oklahoma distributors permitted to make tax exempt sales of gasoline are authorized to accept Class R coupons for non-highway sales of 50 gals or over at retail facilities for which duplicate licenses have been secured for such tax-exempt sales. Records must be kept for OPA inspection. Issued 5-31, effective 6-1.

SUMMER HOT WATER RATIONS: RENEWED SPACE HEATER RATIONS—Rev. RO 11, Am. 9—Interim rations may be issued to serve only until an available substitute facility burning coal or wood can be put into serviceable operating condition. Fuel oil rations issued to users of two facilities may be consumed in either facility or both. New basis given for figuring ration necessary for space heaters, with rules for determining permissible maximum, which no Board may exceed. Rations for a separate water heater, one attached to a space heater or to cooking stove set at 10 gals. for each month needed. Issued 5-30, effective 6-3.

PERIOD 1 COUPONS REDEEMABLE NOW; SPECIAL SUMMER RATIONS RESTRICTED: FUEL OIL RATION BANK ACCOUNTS—Rev. RO 11, Am. 10—Domestic cooking rations for summer months to applicants having available coal or wood-burning equipment permitted only to persons who have used kerosene cooking stoves previously during the summer. To expedite movement of fuel oil, Period 1 coupons made valid at once. Dealers with gasoline ration bank accounts may open fuel oil accounts for same establishments, regardless of volume of business. Issued 6-2, effective 6-6.

PROCEDURE FOR APPLICATION FOR PRICE ADJUSTMENTS; REVIEW; PROTESTS; INTERPRETATIONS—Rev. Proc. Reg. 1, Am. 7—Applications for adjustment shall be filed in duplicate on form prescribed by OPA;

OIL-LAW-Gram Service

Complete texts of all orders or amendments digested in war-oil orders can be had from Platt's Oil-LAW-Gram, 1213 West 3rd street, Cleveland 13, Ohio. Minimum charge single copies $1. Copies of these texts are always in stock but large orders can be promptly filled by reprinting as plates and stencils are also kept.

Complete daily Oil-LAW-Gram service, with necessary binders, $100 per year in advance.

Due care and judgment have been taken in preparing and publishing these digests and in reproducing the original texts but the publisher does not warrant their absolute legal completeness nor accuracy. Important decisions by the reader should be made only after careful study of complete texts.

by letter if no form is designated. Applicants whose requests for adjustment are denied may file request for review with district office, within 60 days of date of mailing denial notice, usually on Form OPA-1PR-2. If again denied, protest may be filed within 60 days. Protests may not be based upon grounds not raised in the application for adjustment. Order denying a protest may include leave to file petition for reconsideration within a certain period, and if such petition is filed, the order of denial is automatically vacated, and the protest proceeding reopened. Interpretations may be requested in writing from nearest district office; these shall be issued in writing only, signed by an authorized OPA officer. Interpretations of general application may be announced only by the Administrator, General Counsel, his associate or assistant counsel, or a regional attorney or regional price attorney. Issued 5-26, effective 5-31.

War Production Board

NEW STEEL DRUMS PERMITTED FOR PACKING ASPHALT, LUBRICATING GREASES, ETC.—L-197, as am. 5-27-44—Asphalt, including mineral filled, cutbacks, emulsions, and road oils may be packed in steel drums up to 75% of amount packed in fibre drums in 1943; lubricating greases up to 50% of such 1943 pack, both in addition to the use of 95% of packer's use of new steel drums for such commodities in 1943. Fuel oil, kerosene, motor fuel, naphtha, solvents, insecticide base, lubricating oil, microcrystalline wax, USP grades of petrolatum, and other petroleum products not listed in Schedule B to L-197 may be packed in steel drums amounting to 95% of packer's industrial usage of new steel drums in 1943. Provisions for alternative methods of determining quota and for application to exceed quota are included. For period 5-15-44 to 7-1-44 packer's quota is one-half of quota for second quarter 1944, and quota to 12-31-44 is 5/8ths of 1944 quota. Quota restrictions are effective 5-27 and all prior authorizations then become void. Issued 5-27.

AUTOMOTIVE MAINTENANCE EQUIPMENT—L-270, as am. 5-27-44—Schedule D added to L-270, consisting of 10 items (bushing grinders, connecting rod attachments, spark plug pumps, etc.) No manufacturer may exceed his 1941 corresponding quarter's production of these items. Added to prohibited-manufactures list are chassis dynamometers, engine reconditioning equipment (except that listed in Schedules B, C, or D), bumper or wheeel rim jacks, and tow bars. Numerous additions made to permitted list (equal to 1941 production), including armature growlers, battery chargers, brake lining grinders, magneto rechargers and tester, piston regrinders. Issued 5-27.

M-300, SCHEDULE 22 NOW GOVERNS BENZENE ALLOCATION—M-137, Revocation—Issued 6-1, effective 7-1.

AROMATIC SOLVENTS—M-150, as am. 6-1-44—New Schedule B and completely revised Schedule A list permitted and prohibited end uses of Class A and Class B solvents. Permitted uses include manufacturing and processing of synthetic rubber, interior linings for cans and metal closures, and interior liners for closures used in food and drug packaging. Class A defined as solvents or naphthas containing over 30% by volume of aromatic hydrocarbons, regardless of source; Class B at toluene range solvents from petroleum or of coal tar origin containing over 30% of aromatic hydrocarbons. Toluene, benzene, xylene as defined in Schedules to M-300 excluded. Issued 6-1.

TEXTILE BAG RESTRICTIONS—M-221, as am. 5-29-44—Burlap bags continue to be permitted for packing petroleum waxes. Letters appealing from M-221's restrictions need follow no particular form, but must state completely, though informally, the provision appealed from, the precise relief desired, the reasons why denial of appeal would cause undue hardship, and any pertinent information. Issued 5-29.

TIRE ALLOTMENT PLAN—R-1, Appendix IV as am. 5-31-44—Manufacturers allotments and production directives established, rules for vehicle manufacturers' applications, for producers' acceptance and shipment of orders, scheduling provisions set forth, and procedure provided for distribution of truck-bus tires, tractor-implement tires, and industrial tires, which are under allocation, among claimant agencies on a quarterly basis. Issued 5-31.

Selective Service System

REPLACEMENT SCHEDULES—Local Board Memorandum 158—Modified to apply primarily to registrants aged 26 through 29. Replacement schedules now in effect remain so until normal expiration date, subject to revision necessary for State Directors to effectuate policies of Memorandum 115, as amended. No new schedules accepted from establishments not now operating under Replacement Schedule program. Existing schedules may be renewed for six months. Further renewal will require Selective Service Director's approval. Until present schedules are amended by State Directors, and until employers have had opportunity to file new deferment requests, local boards are justified in extending deferments for "necessary" war workers 26 through 29 and registrants 30 through 37 who are engaged in war production, or public health, safety, etc. activities. Requests for deferments are filed on Form 42-A Special for ages 18 through 25, on Form 42-A for ages 26 through 29, and on Form 42, 42-A, or 42-B for ages 30 through 37. Issued 6-1.

National War Labor Board

EXCEPTIONS TO EXEMPTION FROM WAGE INCREASE APPROVAL REQUIREMENT—GO 4, Am.—Wage increases for Region XII truck drivers, wholesale and retail distribution establishment workers, and clerical workers require WLB approval, even though fewer than 8 persons are employed. Issued 5-27.

Final Meeting on Delivered-at-Destination Ceilings for Midwest Due This Week

NPN News Bureau

CHICAGO—While the industry in the Midwest awaits further action on the proposed amendment to MPR 88 which would set up delivered-at-destination ceilings on tank car and transport gasoline ond kerosine sales, B. L. Majewski, Deep Rock Oil Corp., is planning a meeting sometime this week with OPA Executive Judd and E. D. Uman, chief of the refined products section of OPA's Petroleum Price Branch, at which he hopes to discuss the final draft of the amendment before issuance.

At a recent meeting in Chicago sponsored by the Midwestern Petroleum Refiners Assn., Mr. Uman explained the amendment to attendant members of the association and other industry men. Mr. Majewski was then called upon by C. L. Henderson, the association's president, and Mr. Uman, to summarize the consensus of the open forum of that day for submission to Mr. Judd. Mr. Majewski's summary is now in the hands of Mr. Judd.

Mr. Majewski's letter to Mr. Judd declares that the price basis outlined in the proposed amendment has not been followed by the industry in the lower peninsula of Michigan and the unanimous opinion of those present at the forum was that it would not be practical to adopt it for that territory. It is formally recommended that in the final draft the word "Michigan" be deleted and "the Upper Peninsula of the State of Michigan" substituted.

New Wording Suggested

Quoting an excerpt from Mr. Judd's original letter explaining the amendment, Mr. Majewski's letter explains the forum's request for clarification of one section. Mr. Judd's letter, he says, states: "It prohibits the charging of a delivered price higher than a certain amount below the tank wagon price in effect on May 1, 1944, for that particular product," and the wording in Sections 1 to 4 of the proposed amendment attached to Mr. Judd's letter reads: "or the dealer tank wagon maximum price as of May 1, 1944." The summary continues with the forum's recommendation that the following clarifying wording be used in Sections 1 to 4: "or the dealer tank wagon maximum **ceiling** price as of May 1, 1944, for ———— grade gasoline at such particular destination less ——c per gallon."

Another point in the summary brings up Mr. Uman's explanation that the pro-

Reply on Wage Law Near

Elwin E. Hadlick, author of the weekly compliance articles appearing in NATIONAL PETROLEUM NEWS, shortly will answer queries raised by a reader concerning operation of the Fair Labor Standards Act and wage freezing.

The information was sought by Loren J. Berry, Theisen-Clemens Co., St. Joseph, Mich., and Mr. Hadlick has advised Mr. Berry that the article will be prepared soon. Because copies of the compliance articles are prepared several weeks in advance of publication, Mr. Hadlick assures Mr. Berry he will send him an advance copy of the article so that he may receive early benefit from his exposition of the subject.

Others in the industry having similar problems are urged to communicate with Mr. Hadlick, Builders Exchange, Minneapolis 2, or with the editor of NATIONAL PETROLEUM NEWS, 1213 W. Third St., Cleveland 13, Ohio.

posed amendment intends to establish maximum delivered tank car and transport truck prices for gasoline jobbers and consumers. Recommendations of the forum, including state jobbing association representatives, are that since it has never been customary to sell tank car buying consumers on the basis of guaranteeing marginal protection, maximum delivered prices for this class of trade should be based on price plus freight from Group 3 to destination, without any marginal protection.

The summary asks that the final draft of the amendment clearly state that the proposed maximum delivered prices and marginal guarantees, whichever are the lower, apply only to tank car and transport truck deliveries to jobbers or "tank wagon resellers" and distributors who are equipped to receive tank car quantities of 8000 gals. or more.

Oppose Shift in Kerosine

Unanimous opinion of the forum was that kerosine prices should be left out of the final draft, since present MPR 88 ceiling prices for kerosine apparently reflect base period prices satisfactory to all concerned in the industry. The summary added, however, that if OPA, contrary to universal industry opinion, insists on spelling out specific maximum delivered prices for kerosine, such specific prices should be the base price for the grade involved (either 41/43 or 42/44 gravity), plus freight from Group 3 to destination, without any guaranteed margin below the tank wagon price.

The summary continues: To avoid further disruption of an already extremely short supply of all grades gasoline, kerosine and all Diesel fuel oil in the area under consideration, the forum consensus recommends the following additional "excepting" amendment to Section 1, 2 of MPR 88 (as amended by Amd. 1), Feb. 14, 1944:

> "Subparagraph (6) Sales made between refiners and between refiners and terminal operators and between terminal operators for the purpose of effectuating Petroleum Directive 65 and other Petroleum Directives concerned with supplying military requirements of 80 octane all-purpose gasoline and Navy 7-0-2 Diesel fuel oil in the States of Illinois, Indiana, Iowa, Kansas, Upper Peninsula of Michigan, Minnesota, Missouri, Nebraska, North Dakota, South Dakota, and Wisconsin."

Summary further recommends: Insertion of a section providing that on contract sales of third grade gasoline the delivered cost at destination to jobbers or "tank wagon resellers" and distributors equipped to receive tank car quantities will not be more than ¼c per gallon less than the laid-down cost of 72/74 oct. as determined under the amendment, whichever is lower; addition of a clarifying proviso which would permit a supplier in the area south and west of Kansas City and in southwestern Missouri to use the mileage or distance rates from whatever Oklahoma point he customarily figured freight in the base period on shipments to destinations in this area.

Mr. Majewski's letter informs Mr. Judd that several Kansas refiners who participated in the forum are writing OPA direct suggesting amendments for consideration concerning shipments from Kansas refiners to destinations within the state of Kansas and for shipments originating in Kansas to Nebraska and western Missouri destinations.

Mr. Majewski closes his letter with the expression of his personal opinion that a substantial segment of the industry favors the issuance of an amendment which will incorporate the foregoing suggestions.

Urges Congress Pressure To Make OPA Use Courts

CLEVELAND—In an effort to obtain favorable congressional action on the Calvin D. Johnson Amendment to H. R. 4376 (extension of the Emergency Price Control Act) J. R. Taylor, vice-president, W. H. Barber Co., Chicago, has sent a first-class letter to the company's entire mailing list, asking that they inform their senators and congressmen that they favor Congressman Johnson's amendment.

The Barber company also sent letters to more than 3000 licensed motor fuel distributors in the Middle West, asking that they do likewise. Similar mailings were made by the Indiana Independent Petroleum Assn., and the Individually Branded Petroleum Assn.

The amendment is as follows:

"This amendment is to be incorporated into H. R. 4376, a bill to extend the Emergency Price Control Act, and provides as follows:

"That the fifth sentence in Section 201 (a) Title II, be stricken. This sentence reads as follows:

" 'Attorneys appointed under this section may appear for and represent the administrator in any case in any court.' "

"That a proviso be added at the end of Section 201 (b) Title II, reading as follows:

" 'Provided, further, that as to any powers and functions relating to priorities or rationing conferred by law upon any other department or agency of the Government with respect to any particular commodity or commodities, transferred to the Office of Price Administration pursuant herewith, no orders suspending a person, firm or corporation from operating a profession, trade or business, shall become effective until after proper judicial hearing in a District Court of the United States having jurisdiction, and the presentation of all cases under this act involving suspension or penalty on behalf of the Federal Government shall be by the several district attorneys of the United States, in their respective districts, under the direction of the Attorney General.' "

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Industry on Sound Basis?

(*Continued from p.* 16)

the shortage and should mean the end of rationing and price fixing and the end of a lot of soft jobs for many tens of thousands of incompetent officeholders. In the oil industry there is certainly a long, long series of floods of crude oil that followed the public's bidding higher prices for what it wants, and which floods always brought lower prices. That price for crude oil, as bid by the oil industry on behalf of the public, is as free and sensitive a price as that of any commodity, we believe, and there are 85 years of history to back it up.

But then, we, and many others, also hold the opinion that neither Bowles, the rest of OPA, the administration nor all their economists want anything but an oil shortage because such a shortage fits their political and reform aims.

Arouses Honest Gasoline Consumers by Exposing, With Pictures, the Gypping Motor Boats

BY THE TIME this gasoline rationing scandal in Cleveland has quieted down, which probably won't be for many weeks, the honest and law-abiding gasoline users of northeastern Ohio probably will be well aware of the sacrifice they have made in giving up their share of gasoline to the lawless users of gasoline. When these law-abiding consumers have come to full realization of how they have been gypped by those consumers, then we can expect some effective compliance with and enforcement of gasoline rationing.

And if and when this consciousness has spread to the breasts of the law-abiding all over the country, then, and only then, will we have fair rationing and full compliance with it.

The newspapers of Cleveland are doing a good job of arousing the awareness of the lawful gasoline consumers to the depredations of their neighbors. Every day each paper publishes extensive stories, not only of the gasoline scandal itself and how it is, or is not, developing, but stories of the inequities and injustices of present gasoline rationing.

Last week, June 2, *The Cleveland Press* told the honest gas consumers of Northeastern Ohio how 3500 motor boat owners in the Greater Cleveland area alone, are consuming at the rate of 371,000 gals. of gasoline this summer for pleasure alone. This, *The Press* says, is equal to a month's supply for 46,375 automobiles using "A" ration coupons. *The Press* puts this story with photos of boats tied up at docks but in the water ready to pleasure-cruise, in a layout 5 columns wide across the top center of its first page in its big afternoon editions. *The Press* insists that today these boats serve no essential war purpose and that they are used solely for pleasure through the sacrifice of honest car drivers.

There is not going to be any solution to our rationing troubles until the HONEST Americans make the DISHONEST ones obey the law, and also see that that law is fair and reasonable and that it is fairly enforced by officials who are themselves honest in every particular. That means that there must be a considerable house-cleaning at Washington before the HONEST American gasoline consumers can have much hope of getting either fair laws or fair enforcement.

These HONEST gasoline consumers must build up such a strong, even belligerent public opinion that every "B" and "C" and other high gasoline ration user will actually feel on the defensive behind his "B" or "C" insignia, will feel that EVERY HONEST American—and that, for the sake of this campaign, will be every "A" ration holder—is challenging his right to that extra gasoline; that even his wife and children are questioning any seeming mis-use of gasoline.

In the midst of this large amount of publicity about Cleveland's dishonest and unpatriotic use of gasoline, the Standard Oil Co. of Ohio publishes two striking advertisements. One appeals to the hearts of all mankind and the other to the honest gasoline user.

The first advertisement is from the series promulgated by the PIWC for national advertising for better compliance with rationing. This advertisement hit at the crux of the whole situation with the headlines,

"Your son is helpless
"Against Black Market gas"

The copy goes straight to the heart of everyone, with the words,

"He's only a kid. He left school, or a job that held promise of a happy future.

"He's only a kid—but he's been trained and equipped to win . . . He WILL win, unless somebody at home lets him down. HE's got to have gasoline . . . for everything he fights with . . . He comes first; he MUST have enough."

The other advertisement that capitalizes on the public interest in this campaign of Cleveland papers, will run this coming Sunday and will be headlined,—

"Shall Racketeers Continue to STEAL YOUR gasoline?"

Then will follow a summary of how much the racketeers and those who use "undeserved" gasoline hurt the honest American gas user. Other ads are planned that will make use of northern Ohio's greater interest in gas rationing by reason of the disclosures to-date.

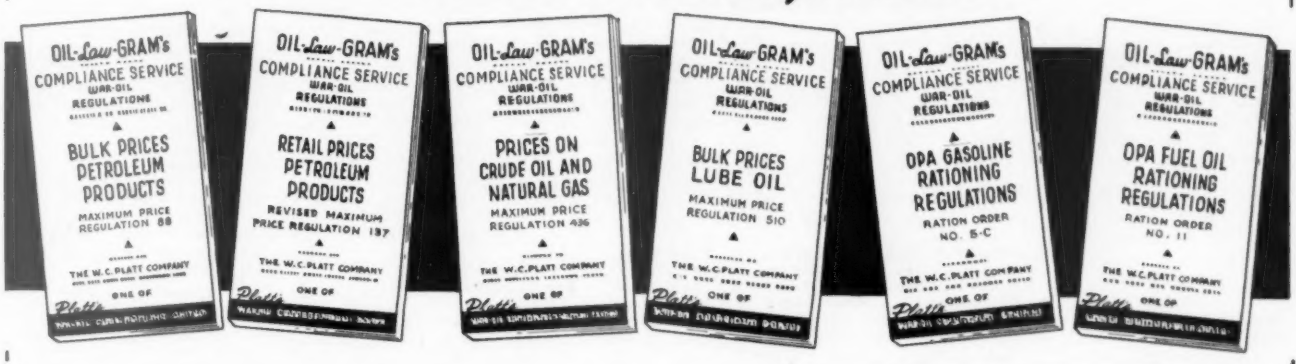
The oil industry generally can get the most results for its rationing money by watching for similar situations to which special advertising copy can be tied. And then at Washington, the industry's representatives can insist to the White House, if necessary, that little can be done to improve public compliance with gas rationing until there is a radical housecleaning at OPA, until honest and fair rationing is put ahead of so-called enforcement which, so often, is nothing but prosecution to satisfy the longings of lawyers for more "law practice".

But the real battle for fair and full rationing and compliance cannot be won until the HONEST and PATRIOTIC AMERICANS step forth and let their dishonest brethren know that they will not stand for any more law defiance. If these HONEST Americans are not enlisted in the fight it is only a question of perhaps even a few short weeks when the average American is going to say "To hell with it. As long as Washington runs a gyp policy and won't enforce the law against ALL violators, I'm not going to sit idle while some one else cruises around on MY gasoline. I'm going to get that gasoline back from the spongers and use it as I damn please, especially as they take the war needs out first anyway."

Backing up these HONEST American gasoline consumers in what they really want to do may not be politically popular these days when some people seem to think more of next November than anything else, because undoubtedly the New Deal's strength lies mostly in the ranks of those who have obtained special gas rations. But backing up these HONEST American gas users will, however, make fair and honest gas rationing work, will give everyone more gasoline fairly, and will do a far better job of helping to win this war than is being done now with the administration's sloppy and incompetent handling of the gasoline situation.

PROTECT YOUR BUSINESS! PROTECT YOURSELF!

Know these War-Oil Regulations . . .



Give Your Associates and Employees a chance to Know the War Regulations that Govern and Guide them and you!

Have You and Your associates and employes who SHOULD know the War Regulations really read them yet?

Have You, the employer, discharged at least some of your duty to them by handing every one who SHOULD KNOW these new war rules, a copy of them? Have you said "Here, read, Study them, that you may be better able to protect yourself and our business, that you may better tell our customers—the general public—what they are expected to do in regard to using the gasoline and oil with care"?

You, and all associates and employes of YOURS, who may read this advertisement, are undoubtedly like all good American oil men—constantly in fear that some one in the company will slip up on some of these many rules and get you all into trouble.

Such ignorance and misunderstanding is no defense before the law, but it is quite human these days of thousands of war orders applying to oil alone, and which have to be carried out by a million or so people in the oil industry.

You, the company management, cannot buy guaranteed protection against excusable ignorance and natural misunderstanding, BUT you can protect yourself somewhat and give your equally anxious employes and associates "a break" by at least giving them a copy of each of the more important regulations with which they are concerned and which govern their daily acts FOR YOU.

TEAR OUT THIS PAGE AND MAIL IT BACK NOW!

Jot down the number of booklets you want on each of these Important War-Oil Regulations, in the space provided therefor beside each Booklet description... Then sign your name and fill in your address on the coupon below and mail this sheet back TODAY for immediate delivery!—Send no money—we'll bill you later.

Pick Out the Booklets That Cover Your Business

No. Needed

____BOOKLET 1—Prices on Fuel Oil, Gasoline, Liquefied Petroleum Gas and Solvents. Known as "Maximum Price Regulation 88." 90 pages. Single Copy Price $1.00. Quantity Rates: 2 to 5—90c, 6 to 10—80c, 11 to 25—70c, 26 to 50—60c, 51 to 100—50c, 101 to 250—45c, 251 to 500—40c, 501 and over—30c.

____BOOKLET 2—Latest revision of Retail Price Order on Motor Fuel, Motor Lubricating Oil, Greases, Kerosene, Prime White Distillate, Nos. 1 and 2 Fuel Oil, Range Oil and Naphthas. Known as "Revised Maximum Price Regulation 137." 20 pages. Rates: Single Copies to 5—50c, 6 to 10—45c, 11 to 25—40c, 26 to 50—35c, 51 to 100—30c, 101 to 250—28c, 251 to 500—25c, 501 and over—23c.

____BOOKLET 3—Crude Petroleum and Natural Gas Prices, including the 10 Amendments. Known as "Maximum Price Regulation 436." 24 pages. Single Copies to 5—50c, 6 to 10—45c, 11 to 25—40c, 26 to 50—35c, 51 to 100—30c, 101 to 250—28c, 251 to 500—25c, 501 and over—23c.

____BOOKLET 4—Bulk ceiling prices for Motor Oils, including Aviation Oils, Stock Oils (neutrals, bright stocks, steam refined and other stock oils), Greases, Industrial Oils, Petroleum Sulphonates, Mineral Oil Polymers, and any other fraction of crude petroleum which is sold as a source of any of the foregoing commodities. Known as "Maximum Price Regulation 510." 24 pages. Single Copies to 5—50c, 6 to 10—45c, 11 to 25—40c, 26 to 50—35c, 51 to 100—30c, 101 to 250—28c, 251 to 500—25c, 501 and over—23c.

____BOOKLET 5—Gasoline Rationing, including Am. No. 114, known as "Ration Order 5C." 204 pages. Single Copy $1.00. Quantity Rates: 2 to 5—90c, 6 to 10—85c, 11 to 25—80c, 26 to 50—70c, 51 to 100—60c, 101 to 250—50c, 251 to 500—45c, 501 and over—40c.

____BOOKLET 6—Fuel Oil Rationing, including all 95 amendments and omitting the obsolete material. Known as "Revised Ration Order No. 11." 175 pages. Single Copy $1.25. Quantity Rates: 2 to 5—$1.15, 6 to 10—$1.00, 11 to 25—90c, 26 to 50—85c, 51 to 100—80c, 101 to 250—70c, 251 to 500—60c, 501 and over—50c.

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Company _____

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WAR-OIL COMMUNICATION SERVICES

Refinery Operations

(American Petroleum Institute figures in thousands of barrels of 42 gal. each. Figures include reported totals plus estimate of unreported amounts and are therefore on a Bureau of Mines basis.)

Districts	Daily Potential Refining Capacity Week Ended May 27	Daily Potential Refining Capacity Week Ended May 20	Per Cent of Refining Capacity Reporting Week Ended May 27	Per Cent of Refining Capacity Reporting Week Ended May 20	Daily Average Crude Runs to Stills Week Ended May 27	Daily Average Crude Runs to Stills Week Ended May 20	Per Cent of Reporting Capacity Operated Week Ended May 27	Per Cent of Reporting Capacity Operated Week Ended May 20
Combined°°	2,518	2,518	90.3	90.3	2,410	2,313	95.7	91.9
Appalachian (Dist. No. 1)	130	130	83.9	83.9	102	105	78.5	80.8
Appalachian (Dist. No. 2)	47	47	87.2	87.2	59	53	125.5	112.8
Ind., Ill., Ky.	824	824	85.2	85.2	752	763	91.3	92.6
Okla., Kans., Mo.	418	418	80.2	80.2	363	361	86.8	86.4
Rocky Mt. (Dist. No. 3)	8	8	26.9	26.9	13	12	162.5	150.0
Rocky Mt. (Dist. No. 4)	141	141	58.3	58.3	94	92	66.7	65.2
California	817	817	89.9	89.9	739	784	90.5	96.0
Total U. S.—B. of M. Basis	4,903	4,903	87.3	87.3	4,532	4,483	92.4	91.4
U. S.—B. of M. Basis May 29, 1943					3,671			

Districts	Gasoline Production at Refineries inc. Natural Blended Week Ended May 27	Gasoline Production at Refineries inc. Natural Blended Week Ended May 20	Stocks of Finished and Unfinished Gasoline Week Ended May 27	Stocks of Finished and Unfinished Gasoline Week Ended May 20	Total Stocks Gas Oil & Distillates Week Ended May 27	Total Stocks Gas Oil & Distillates Week Ended May 20	Total Stocks Residual Fuel Oil Week Ended May 27	Total Stocks Residual Fuel Oil Week Ended May 20
Combined°°	6,663	6,449	37,468	38,226	16,857	16,085	14,520	14,639
Appalachian (Dist. No. 1)	306	341	2,015	2,452	884	484	250	232
Appalachian (Dist. No. 2)	154	132	1,153	1,264	393	132	182	161
Ind., Ill., Ky.	2,726	2,774	19,584	19,549	4,530	5,064	2,791	2,782
Okla., Kans., Mo.	1,279	1,320	8,294	8,252	1,310	1,320	1,303	1,229
Rocky Mt. (Dist. No. 3)	37	40	70	75	6	6	31	29
Rocky Mt. (Dist. No. 4)	358	357	2,305	2,271	317	334	562	549
California	1,979	2,123	15,579	15,873	7,738	7,653	30,173	30,356
Total U. S.—B. of M. Basis May 27	13,502	13,536	86,468	°87,892	32,035	31,088	49,812	49,977
U. S.—B. of M. Basis May 29, 1943	10,736		84,477		30,657		67,608	

°Finished 74,373,000 bbls.; Unfinished 12,095,000 bbls.

°°Includes East Coast, Inland Texas, Texas Gulf, Louisiana Gulf and North Louisiana-Arkansas districts.

U. S. Crude Oil Production

(American Petroleum Institute figures)

	WEEK ENDED May 27 Barrels (Daily Average)	WEEK ENDED May 20 Barrels (Daily Average)
Oklahoma	333,650	333,850
Kansas	283,550	283,800
Nebraska	950	1,000
Texas	1,995,500	1,995,500
Louisiana	356,650	356,900
Arkansas	80,650	80,450
Mississippi	40,400	41,050
Alabama	100	100
Florida	50	50
Illinois	208,500	214,600
Indiana	13,450	12,350
Eastern (Ill., Ind. & Ky. excluded)	71,900	70,850
Kentucky	20,700	21,650
Michigan	51,600	46,350
Wyoming	85,750	81,150
Montana	21,300	21,400
Colorado	8,350	8,200
New Mexico	108,200	108,200
California	3,681,250	835,900
Total, U. S.	4,514,050	4,513,400

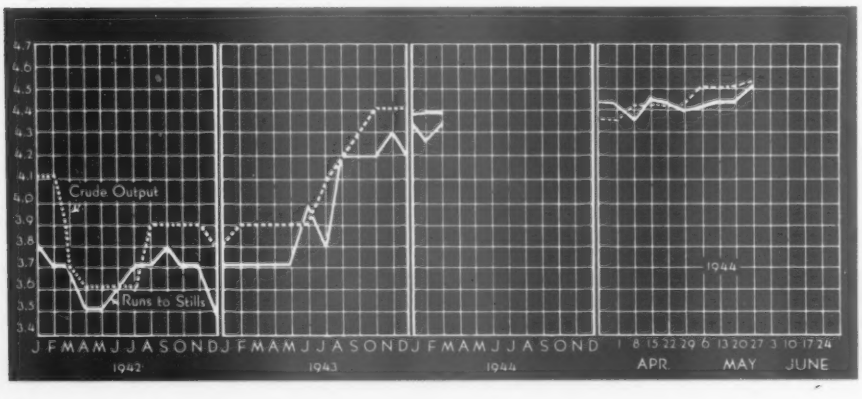
Crude Oil Stocks

(Bureau of Mines Figures in thousands of bbls.)

Grade or Origin	May 20	May 27	Change from May 20
Penna. Grade	2,543	2,721	+178
Other Appalachian	1,588	1,590	+ 2
Lima-Michigan	933	918	— 15
Illinois-Indiana	14,884	15,125	+241
Arkansas	2,770	2,699	— 71
Kansas	7,855	8,127	+272
Louisiana:	14,073	14,280	+207
Northern	3,492	3,548	+ 56
Gulf Coast	10,581	10,732	+151
Mississippi	1,076	1,019	— 57
New Mexico	6,782	6,987	+205
Oklahoma	32,446	32,058	—388
Texas:	115,001	113,860	—1,141
East Texas	22,706	22,549	—157
West Texas	30,110	29,676	—434
Gulf Texas	33,409	32,608	—801
Other Texas	28,776	29,027	+251
Panhandle	6,138	6,213	+ 75
North	6,490	6,217	—273
South	5,832	6,325	+493
Other	10,316	10,272	— 44
Rocky Mountain	9,638	9,620	— 18
California	22,991	23,401	+410
Foreign	1,719	2,018	+299
Total gasoline-bearing in U. S.	234,299	234,423	+124
Heavy in California	6,131	5,989	—142

Crude Production & Runs to Stills

(Millions of Barrels)


Crude Output
Runs to Stills
1944
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D 1 8 15 22 29 6 13 20 27 3 10 17 24
1942
1943
1944
APR.
MAY
JUNE

N.P.N. Gasoline Index

	Dealer T.W. Car Cents Per Gal.	Tank Car Cents Per Gal.
June 5	10.51	6.17
Month ago	10.51	6.65
Year ago	10.37	6.75

Dealer index is an average of "undivided" dealer prices, ex-tax, in 50 cities.

Tank car index is weighted average of following wholesale markets for regular-grade gasoline, FOB refineries or terminals: Okla., Mid-Western, W. Penna., Calif., N. Y. Harbor, Philadelphia, Jacksonville, Boston and Gulf Coast.

Pennsylvania Crude Runs

(Compiled by National Petroleum Assn. from reports of all companies refining Pennsylvania crude. Figures in bbls.)

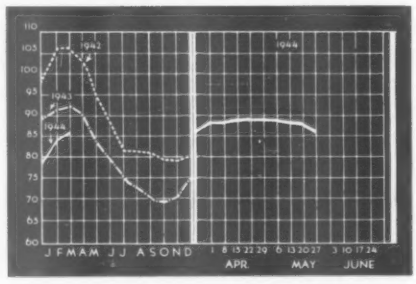
DAILY AVERAGE

Week Ended May 27, 1944	Week Ended May 20, 1944	Week Ended May 29, 1943
66,880	64,340	76,488

May 13 crude runs were 64,231 instead of 63,220, as reported last week, N.P.A. reports.

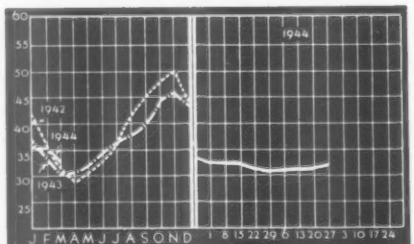
Gasoline Stocks

(Millions of Barrels)



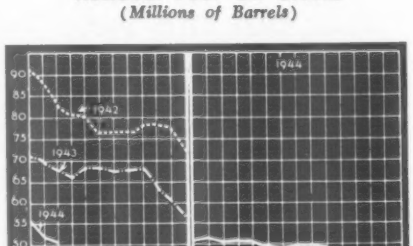
Gas Oil & Distillate Stocks

(Millions of Barrels)



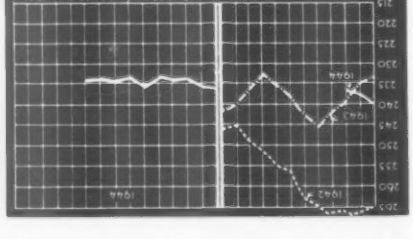
Residual Fuel Oil Stocks

(Millions of Barrels)



Crude Oil Stocks

(Millions of Barrels)



Market Reports

ATLANTIC COAST — Markets reported steady this week, with prices firm at current quoted levels. Gasoline supplies were reported tight in New York, with supplies being held for regular trade only. Southern distributor seeking housebrand gasoline from Gulf refiners claims stocks and storage facilities in good shape, but local market prices are in excess of marginal profit.

Kerosine is still "spotty," and residuals long. Marketers report allocations generally unchanged.

° ° °

GULF COAST—Refiner in New Orleans who has been quoting 4.125c on 41-43 kerosine, in tank cars, and 3.75c on No. 2 fuel oil withdrew his quotations for lack of material. Price ranges of 4.25-4.125c and 3.75c respectively remain unchanged.

All products continue tight, with calls from eastern suppliers heavy. Spot sales practically non-existent, with materials being held for regular trade only. Bulk of all material under Government consignment.

° ° °

MIDWEST—Advent of warm weather brought agricultural demand for gasoline and tractor fuels to peak in some areas last week. Terminal storage of gasoline, along with refiner storages, are in majority of cases completely depleted and refiners are filling orders from daily production alone. Attempts at interrefinery purchases of motor fuel meeting with little success. Refiners report, however, that easing of restrictions on refinery runs will probably permit filling of regular customers gasoline demands despite 5% increase in military take for June.

Heating oil demand continues at seasonal low although products are exceptionally short, principally, refiners and marketers report, because of Navy 702 Diesel program. Lubricating oils are moving steadily with no apparent change in demand. Reports of residual oil surpluses noted in some areas while others feeling distinct shortage. Eastern markets no longer absorbing previously large quantities of residual from midwestern marketers because of their own increased production of the heavy oils, allowing for easing of picture. War plants refusal of high sulfur content residuals permits further accumulation in some areas. Problem seems to be strictly one of inadequate transportation to move heavy oils from surplus areas to territory where shortage prevails.

No price changes.

° ° °

PENNSYLVANIA — Steady inquiries reported for all refined products throughout Western Penna. Lubricating oils especially scarce with refiners trying to find some to buy for July orders. Finished petrolatums moving steadily with raw stocks available at ceiling prices.

Neutrals are being offered in limited quantity with supplies held for regular trade only. Naphthas and waxes steady. All prices firm at current quoted levels.

° ° °

MIDCONTINENT — Heavy demand for gasoline from farm trade is causing increase in difficulties of obtaining transport trucks, refiners say. Requests for ODT permits to use tank cars to move civilian products are being made by Kansas refiners. Oklahoma refiner reported trouble even in finding trucks to move war products.

Gasoline and kerosine continue "tight" but majority of refiners say they are "not too far behind with orders now". Call for burning oils and kerosine is unusually strong for this season.

West Texas refiner reported open spot sale of three cars regular gasoline at 6c and 3 cars of Ethyl at 7c shipped to Districts 1 and 2 in seller's cars.

Ten cars Grade 26-70 natural gasoline reported sold at 4.375c F.O.B. Breckenridge. No open spot sales reported FOB Group 3; sellers quoted 4.75c during the week.

CALIFORNIA—The gasoline market continues tight. The tank wagon delivered price range has a spread of about 1c. The stove oil market has held better than in past years. Some refiners say this is due to large number of new houses being built in this area which rely entirely upon stove oil for fuel. Market for the product is from 4.5c to 5c.

CRUDE PRICES

Since changes in crude oil prices are so few, the two pages of crude oil price tables hereafter will be printed only when there are sufficient changes in prices to warrant.

In the meantime a record is being kept in the Cleveland office of NPN and OILGRAM from which the publishers will be glad to make proofs, or letters or affidavits as to what the prices are, and without charge to regular subscribers.

Crude Price Changes

Independent Pipe Line Co. initiated a gravity scale for Falls City, Nebr. Crude, supplanting flat field price of $0.90. Schedule begins with 28-28.9 at $1.01 and ends with 31-31.9 at $1.07.

Imperial Oil Ltd., Toronto, announced 2c per bbl. increase in Turner Valley crude oil, new schedule beginning with 33-33.9 at $1.52 and ending with 64 and above at $2.14.

In Rocky Mountain fields, Big Muddy, Wyo. crude was advanced from $1.08 to $1.13 and Lance Creek, Wyo. from $1.12 to $1.25.

Complete crude prices will be published in the June 14 issue of NPN.

Summary of Daily Gasoline Prices (May 29 to June 5)

	Monday June 5	Friday June 2	Thursday June 1	Wednesday May 31	Tuesday May 30
U. S. Motor (ASTM octane)					
76 octane Ethyl:					
Oklahoma	6.75	6.75	6.75	6.75	6.75
Mid-Western (Group 3 basis)	6.75 - 7.25	6.75 - 7.25	6.75 - 7.25	6.75 - 7.25	6.75 - 7.25
N. Tex. (For shpt. to Tex. & N. M. dest'ns.)	7	7	7	7	7
W. Tex. (For shpt. to Tex. & N. M. dest'ns.)	7 (2)	7 (2)	7 (2)	7 (2)	7 (2)
72 octane:					
Oklahoma	6	6	6	6	6
Mid-Western (Group 3 basis)	6	6	6	6	6
N. Tex. (For shpt. to Tex. & N. M. dest'ns.)	6	6	6	6	6
W. Tex. (For shpt. to Tex. & N. M. dest'ns.)	6	6	6	6	6
63-66 octane:					
Oklahoma	5.625 (2)	5.625 (2)	5.625 (2)	5.625 (2)	5.625 (2)
Mid-Western (Group 3 basis)	5.625	5.625	5.625	5.625	5.625
N. Tex. (For shpt. to Tex. & N. M. dest'ns.)	5.625 (1)	5.625 (1)	5.625 (1)	5.625 (1)	5.625 (1)
W. Tex. (For shpt. to Tex. & N. M. dest'ns.)	5.75 (1)	5.75 (1)	5.75 (1)	5.75 (1)	5.75 (1)
60 octane & below:					
Oklahoma	5.25	5.25	5.25	5.25	5.25
Mid-Western (Group 3 basis)	5.2 - 5.25	5.2 - 5.25	5.2 - 5.25	5.2 - 5.25	5.2 - 5.25
N. Tex. (For shpt. to Tex. & N. M. dest'ns.)	5.2 - 5.25	5.2 - 5.25	5.2 - 5.25	5.2 - 5.25	5.2 - 5.25
W. Tex. (For shpt. to Tex. & N. M. dest'ns.)	5.25	5.25	5.25	5.25	5.25
Motor Gasoline, 72 octane (ASTM)					
New York harbor	9.2 - 9.4	9.2 - 9.4	9.2 - 9.4	9.2 - 9.4	9.2 - 9.4
New York harbor, barges	9.1 - 9.3	9.1 - 9.3	9.1 - 9.3	9.1 - 9.3	9.1 - 9.3
Philadelphia district	9.2	9.2	9.2	9.2	9.2
Baltimore district	8.95	8.95	8.95	8.95	8.95
Motor Gasoline:					
Western Penna. Bradford-Warren:					
"Q" Gasoline, Min. 70 Oct. (ASTM)	7.75 - 8.95	7.75 - 8.95	7.75 - 8.95	7.75 - 8.95	7.75 - 8.95
Western Penna. Other Districts:					
"Q" Gasoline, Min. 70 Oct. (ASTM)	7.75 - 8.45	7.75 - 8.45	7.75 - 8.45	7.75 - 8.45	7.75 - 8.45

OIL PRICE SECTION ★ At Refineries and Terminals and by Tank Wagon

Prices herewith are reproduced from Platt's *OILGRAM* Daily Oil Price Service, associated with National Petroleum News, whose representatives in all NPN-OILGRAM offices devote their time exclusively to reporting oil industry prices everywhere.

Prices shown are actual sales prices, or quotations meaning sellers' general offers or posted prices; for current sales and shipment; for the business day or period stated; except Tank Wagon prices, prices are for bulk lots such as tank car and motor transport; barge or tanker cargo lot prices are identified; FOB refineries or terminals; in cents per gal. except where shown in bbls. of 42 gals.; ex all fees and taxes; for crude oil and its products lawfully produced and transported; reported as received by *OILGRAM* and National Petroleum News but not guaranteed; for subscribers' private use only and not for resale or distribution or publication. For further details of price conditions apply to any *NPN-OILGRAM* office or see back of any *OILGRAM* Price Service invoice.

For complete price service delivered daily from nearest *OILGRAM* publishing office, New York, Cleveland and Tulsa, Okla. address Platt's *OILGRAM*, 1213 W. 3rd St., Cleveland (13), Ohio. Annual subscription rate payable in advance $100 a year via train mail and $125 per year via air mail.

Refinery Prices

Gasoline —U. S. Motor (A S T M) except where otherwise specified

Prices in Effect	June 5	May 29
OKLAHOMA		
76 oct. Ethyl...	6.75	6.75
72 oct.....	6	6
63-66 oct.....	5.625(1)	5.625 (2)
60 oct. & below..	5.25	5.25
60-62, 400 e.p....	5.25 (1)	5.25 (1)
MID-WESTERN (Group 3 basis)		
76 oct. Ethyl...	6.75 – 7.25	6.75 – 7.25
72 oct.....	6	6
63-66 oct.....	5.625	5.625
60 oct. & below..	5.2 – 5.25	5.2 – 5.25
N. TEX. (For shpt. to Tex. & N. M. dest'ns.)		
76 oct. Ethyl...	7	7
72 oct.....	6	6
63-66 oct.....	5.625 (1)	5.625 (1)
60 oct. & below..	5.2 – 5.25	5.2 – 5.25
60-62, 400 e.p...	5.375 (1)	5.375 (1)
W. TEX. (For shpt. to Tex. & N. M. dest'ns.)		
76 oct. Ethyl...	7 (2)	7 (2)
72 oct.....	6	6
63-66 oct.....	5.75 (1)	5.75 (1)
60 oct. & below..	5.25	5.25
CENT. W. TEX. (Prices to truck transports)		
76 oct.....	7 (2)	7 (2)
72 oct.....	6 (2)	6 (2)
67-69 oct.....	....	....
62 oct & below..	5.25 (2)	5.25 (2)
AMARILLO, TEX. (For shpt. to W. Okla. & Tex. differential territory.)		
60 oct. & below..	No Price	No Price
60-62, 400 e.p...	No Price	No Price
KANSAS (For Kansas destinations only)		
76 oct. Ethyl...	7.25 – 7.5 (2)	7.25 – 7.5(2)
72 oct.....	6.25 – 6.3	6.25 – 6.3
63-66 oct.....	5.9 (2)	5.9 (2)
60 oct. & below	5.5	5.5
ARK. (For shipment to Ark. & La.)		
76 oct. Ethyl...	7 (1)	7 (1)
72 oct., leaded..	6 (1)	6 (1)
70-72 oct. "	5.875 (1)	5.875 (1)
62 oct. "	....	....
60 oct. & below, leaded.....	5.25 (1)	5.25 (1)
WESTERN PENNA. (Motor gasoline)		
Bradford-Warren:		
"Q" Gasoline, Min. 70 Oct. (ASTM)	7.75 – 8.95	7.75 – 8.95
Other districts:		
"Q" Gasoline, Min. 70 Oct. (ASTM)	7.75 – 8.45	7.75 – 8.45

Prices in Effect	June 5	May 29
CENTRAL MICHIGAN (FOB Central Mich. refinery group basis for shpt. within Mich.; shpts. may originate at plants outside Central group.)		
U.S. Motor: (Oct. ASTM):		
72 oct.....	8 – 8.5	8 – 8.5
67-69 oct.....	....	....
Str. run gasoline, excluding Detroit shpt.....	6	6
OHIO (S. O. Ohio quotations for statewide delivery and subject to exceptions for local price disturbances).		
72 oct.....	8.375	8.375
CALIFORNIA U.S. Motor:		
76 oct. (Ethyl)....	7.5 – 8.75	7.5 – 8.75
70-72 oct. (regular)	6.5 – 7.75	6.5 – 7.75
65 oct. & below (3rd grade).....	6.5 – 6.75	6.5 – 6.75

Kerosine, & Gas Fuel Oils

OKLAHOMA		
41-43 grav. w.w...	4.375	4.375
42-44 grav. w.w...	4.5	4.5
Range Oil.....	4	4
No. 1 P.W.....	3.875	3.875
No. 1 straw.....	....	....
No. 2 straw.....	3.625	3.625
No. 3 fuel.....	3.5 (2)	3.5 (2)
U. G. I. Gas Oil...	....	....
No. 6 fuel.....	....	....
14-16 fuel.....	$0.97 (2)	$0.97 (2)
MID-WESTERN (Group 3 basis)		
41-43 grav. w.w...	4.375	4.375
42-44 grav. w.w...	4.5	4.5
Range Oil.....	4 –4.1 (2)	4 – 4.1(2)
No. 1 p.w.....	3.875	3.875
No. 2 straw.....	3.625	3.625
No. 3.....	....	....
No. 5.....	....	....
No. 6.....	$0.80 (1)	$0.80 (1)
N. TEX. (For shpt. to Tex. & N. M. dest'ns.)		
41-43 grav. w.w....	4.375	4.375
42-44 grav. w.w....	4.5 (1)	4.5 (1)
No. 1 P.W.....	3.875 (1)	3.875 (1)
AMARILLO, TEX. (For shpt. to W. Okla. & Tex. differential territory.)		
42-44 grav. w.w...	4.5 (1)	4.5 (1)
No. 1 straw.....	No Price	No Price
KANSAS (For Kansas destinations only).		
41-43 grav. w.w...	No Price	No Price
42-44 grav. w.w...	4.7 – 4.75	4.7 – 4.75
No. 1 p.w.....	4.1	4.1
No. 6 fuel.....	$0.85	$0.85
ARK. (For shipment to Ark. and La.)		
41-43 grav. w.w...	....	....
42-44 w.w. kero...	4.5 (1)	4.5 (1)
No. 1.....	4 (1)	4 (1)
No. 2.....	3.625 (1)	3.625 (1)
No. 3 fuel.....	3.5 (1)	3.5 (1)
Tractor fuel, for shpt. to Ark. points only....	5.125 (1)	5.125 (1)
Diesel fuel 52 & below.....	4 (1)	4 (1)
Diesel fuel 58 & above.....	4.25 (1)	4.25 (1)
WESTERN PENNA.		
Bradford-Warren:		
45 grav. w.w.....	6.55 – 8.05	6.55 – 8.05
46 grav. w.w.....	6.675 (1)	6.675 (1)
No. 1 fuel.....	6.55-8.05 (b)	6.55–8.05(b)
No. 2 "	6.125-7.625(b)	6.125-7.625(b)
No. 3 "	6.25-7.75(b)	6.25-7.75(b)
36-40 gravity.....	6.625-6.75 (2)	6.625-6 75(2)

(b) Lows of price range for Dist. 1 and highs for other districts.

Other districts:		
45 grav. w.w.....	7.25 – 7.925	7.25 – 7.925
46 grav. w.w.....	7.25 – 7.625	7.25 – 7.625
47 grav. w.w.....	7.375– 7.875	7.375– 7.875
No. 1 fuel.....	6.875– 7.375	6.875– 7.375
No. 2 "	6.75 – 7.375	6.75 – 7.375
No. 3 "	6.75 – 7.375	6.75 – 7.375
36-40 grav. Pittsburgh dist. prices excluded.....	6.625– 7.375	6.625– 7.375
CENTRAL MICHIGAN (FOB Central Mich. refinery group basis for shpt. within Mich.; shpts. may originate at plants outside Central group.)		
47-49 gravity w.w.	5.8 – 6	5.8 – 6
P W. Distillate...	5.5	5.5
No. 3 gas oil, Straw	5	5
U.G.I. gas oil.....	4.5 (2)	4.5 (2)
Fuel Oils (*Vis. at* 100).		
300-500 Vis.....	....	....
100-300 Vis.....	4.5	4.5
OHIO (S. O. quotations for statewide delivery)		
Kerosine.....	7	7
CALIFORNIA		
40-43 grav. w.w...	5 – 7	5 – 7
San Joaquin Valley:		
Heavy fuel.....	$1.10 (2)	$1.10 (2)
Light fuel.....	$1.20 (2)	$1.20 (2)
Diesel fuel.....	4 (2)	4 (2)
Stove dist.....	5 (2)	5 (2)
Los Angeles:		
Heavy fuel.....	$1.10 (2)	$1.10 (2)
Light fuel.....	$1.20(2)	$1.20 (2)
Diesel fuel.....	4 (2)	4 (2)
Stove dist.....	5	5
San Francisco:		
Heavy fuel.....	$1.15 (1)	$1.15 (1)
Light fuel.....	$1.25 (1)	$1.25 (1)
Diesel fuel.....	4.5 (1)	4.5(1)
Stove dist.....	5.5 (1)	5.5(1)

NOTE: All above heavy fuels meet Pacific specification 400; light fuel, spec. 300, Diesel fuels, spec. 200; and stove distillate, spec. 100.

Lubricating Oils

Prices in Effect	June 5	May 29
WESTERN PENNA.		
Prices are for sales made, or offers reliably reported, to jobbers & compounders only.		
Viscous Neutrals—*No. 3 col. Vis. at* 70°*F.*		
200 Vis. (180 at 100°) 420-425 fl.		
0 p.t.....	38 (1)	38 (1)
10 p.t.....	37 (1)	37 (1)
15 p.t.....	36 (1)	36 (1)
25 p.t.....	28–33	28–33
150 Vis. (143 at 100°) 400-405 fl.		
0 p.t.....	36 (1)	36 (1)
10 p.t.....	35 (1)	35 (1)
15 p.t.....	34 (1)	34 (1)
25 p.t.....	26–31	26–31

Cylinder Stocks

Brt. stk., 145-155 *vis. at* 210°, 540-550 fl., *No. 8 col.*		
10 p.t.....	30.5 (1)	30.5 (1)
15 p.t.....	29.5 (1)	29.5 (1)
25 p.t.....	25	25
600 S.R. filterable.	15	15
650 S.R.....	15.5	15.5
600 fl.....	16	16
630 fl.....	17	17

MID-CONTINENT (F. o. b. Tulsa)

Neutral Oils (*Vis. at* 100° *F to* 10 *P.P.*)

Pale Oils:

Vis. Color		
60-85—No. 2....	7.5 (a)	7.5 (a)
86-110—No. 2...	7.5 – 8.5	7.5–8.5
150—No. 3.....	11–11.5 (a)	11–11.5 (a)
180—No. 3.....	11.5 –15	11.5–15
200—No. 3.....	12 –15	12 –15
250—No. 3.....	14 –16.5	14 –16.5
280—No. 3.....	15 –17	15 –17
300—No. 3.....	16 –18	16 –18

(a) Retroactive to May 8.

Red Oils:

180—No. 5.....	11.5 (1)	11.5 (1)
200—No. 5.....	12	12
280—No. 5.....	No Price	No Price
300—No. 5.....	16-17.5 (2)	16-17.5(2)

NOTE: Discounts of 0.5c to 0.1c on bright stock and 0.5c to 0.2c allowed for neutrals on contracts, 10 car lots, and to "meet competition." Brokers offering at greater discounts.

Bright Stock—*Vis. at* 210°

200 Vis. D.....	27 (1)	27 (1)
150-160 Vis. D:		
0 to 10 p.p.....	23	23
10 to 25 p.p.....	22.5–23	22.5–23
25 to 40 p.p.....	23 (1)	23 (1)
150-160 Vis. E....	22 (1)	22 (1)
120 Vis. D:		
0 to 10 p.p.....	22 (2)	22 (2)
600 S.R. Dark Green.....	8.5 (1)	8.5 (1)
600 S.R. Olive Green.....	10–11 (2)	10–11 (2)
631 S.R.....	....	....
Black Oil.....	5.5 (1)	5.5 (1)

NOTE—Discounts of 0.5c to 2c off for contracts to "meet competition". Brokers offerings at greater discounts.

SOUTH TEXAS Neutral Oils

Pale Oils (*Vis. at* 100°*F.*)

Vis. Color		
100 No. 1½-2½.	6.5	6.5
200 No. 2-3.....	8.75	8.75
300 No. 2-3.....	9.25	9.25
500 No. 2½-3½.	10	10
750 No. 3-4.....	10.25	10.25
1200 No. 3-4.....	10.375	10.375
2000 No. 4.....	10.5	10.5

(Continued on next page)

NOTE—Parenthetical figures after prices indicate number of companies quoting when less than three companies are quoting.

NOTICE—Owing to great demand, refiners generally limit quotations to regular customers and refuse bids, though higher, from others. Refiners' prices and sales shown; bids reported in market leads.

Refinery Prices (Continued)

Prices in Effect	June 5	May 29
Red Oils:		
100 No. 5-6	6.5 (2)	6.5 (2)
200 No. 5-6	8.75	8.75
300 No. 5-6	9.25	9.25
500 No. 5-6	10	10
750 No. 5-6	10.25	10.25
1200 No. 5-6	10.375	10.375
2000 No. 5-6	10.5	10.5

CHICAGO (From Mid-Continent p.l. crude.)
Neutral oils *sis. at* 100° *F. 0 to* 10 *p. p.*

Pale Oils		
Vis. Color		
60-85—No. 2	9 (1)	9 (1)
86-110—No. 2	9.25 (1)	9.25 (1)
150—No. 3	12.5 (1)	12.5 (1)
180—No. 3	13 (1)	13 (1)
200—No. 3	13 (1)	13 (1)
250—No. 3	14 (1)	14 (1)
Red Oils:		
180—No. 5	13 (1)	13 (1)
200—No. 5	13 (1)	13 (1)
250—No. 5	14 (1)	14 (1)
280—No. 5	15 (1)	15 (1)
300—No. 5	15.5 (1)	15.5 (1)

Note: Viscous oils, 15 to 30 p.p. are quoted 0.5c lower; 60-85 and 86-110 No. 2 non-viscous oils, 15 to 30 p.p., 0.25c lower.

Unfiltered Steam Refined: (*Viscosity at* 210°)

140	11.5 (1)	11.5 (1)
160	12.5 (1)	12.5 (1)
200	13.5 (1)	13.5 (1)

Bright stocks, 160 *sis. at* 210 *No.* 8 *color:*

0 to 10 p.p.	24 (1)	24 (1)
15 to 25 p.p.	23.5 (1)	23.5 (1)
30 to 40 p.p.	21.5 (1)	21.5 (1)
E filtered Cyl. Stock	15.5 (1)	15.5 (1)

Note: To obtain prices delivered in Chicago, add 0.25c per gal.

Natural Gasoline

(Group 3 & Breckenridge prices are to blenders on freight basis shown below. Shipments may originate in any Mid-Continent manufacturing district.)

FOB GROUP 3		
Grade 26-70	4.75 (Quote)	4.75 (Quote)
FOB BRECKENRIDGE		
Grade 26-70	4.375 (Quote)	4.375 (Quote)

CALIFORNIA (FOB plants in Los Angeles basin)

21 pound vapor pressure for blending	4.75 - 5.375	4.75 - 5.375

Naphtha and Solvent

(*FOB Group* 3)

Stoddard solvent	6.625	6.625
Cleaners' naphtha	7.125	7.125
V.M.&P. naphtha	7.1 - 7.125	7.1 - 7.125
Mineral spirits	6.1 - 6.125	6.1 - 6.125
Rubber solvent	7.1 - 7.125	7.1 - 7.125
Lacquer diluent	7.375- 8.125	7.375- 8.125
Benzol Diluent	7.875- 8.625	7.875- 8.625
WESTERN PENNA.		
Bradford-Warren District:		
Stoddard Solvent	7.5 (1)	7.5 (1)
Other Districts:		
Untreated naphtha	7 - 7.25	7 - 7.25
Stoddard solvent	7.25 - 8	7.25 - 8

OHIO (S. O. quotations for statewide delivery): V.M.&P. naphtha, D.C. naphtha, Varnolene &

Sohio solvent	10	10
Rubber solvent	9	9

Wax

WESTERN PENNA. (Bbls. C.L.)

White Crude Scale:		
122-124 A.m.p.	4.25 (2)	4.25 (2)
124-126 A.m.p.	4.25	4.25

OKLAHOMA (C.L. FOB Refinery)

Semi-refined:		
128 AMP min., white, 50 kilo bags	No Price	No Price
132-134 AMP, bbls.	5.25 (1)	5.25 (1)

CHICAGO (FOB Chicago district refinery of one refiner, in bags, carloads. Carloads, slabs loose 0.4c less. Melting points are EMP (ASTM) methods; add 3° to convert into AMP.)

Fully refined:		
122-124 (bags only)	5.6	5.6
125-127	6	6
127-129	6.25	6.25
130-132	6.55	6.55
132-134	6.8	6.8
135-137	7.55	7.55

Petrolatums

WESTERN PENNA. (Bbls., carloads; tank cars 0.5c per lb. less.)

Snow White	6.125- 7.25	6.125- 7.25
Lily White	5.375- 6.25	5.375- 6.25
Cream White	4.375- 5.5	4.375- 5.5
Light Amber	3.375- 4	3.375- 4
Amber	3.125- 3.75	3.125- 3.75
Red	3 - 3.5	3 - 3.5

Tank Wagon Prices

Commercial or consumer tank car, tank wagon, dealer, and service station prices for gasoline **do not include taxes;** *they do, however, include inspection fees as shown in general footnote. Gasoline taxes, shown in separate column, include* 1.5c *federal, and state taxes; also city and county taxes as indicated in footnotes. Kerosine tank wagon prices also do not include taxes; kerosine taxes where levied are indicated in footnotes. Dealer discounts are shown in footnotes. These prices in effect June* 5, 1944 *as posted by principal marketing companies at their headquarters offices, but subject to later correction.*

S. O. N. J. — **Esso** (*Regular Grade*)

	Consumer Tank Wagon	Dealer T.W.	Gasoline Taxes	Kerosine T.W.
*Atlantic City, N. J.	10.2	10.7	4.5	10
*Newark, N. J.	10.2	10.7	4.5	10
Annapolis, Md.	10.55	11.05	5.5	....
Baltimore, Md.	9.95	10.45	5.5	10.8
Cumberland, Md.	11.35	11.85	5.5	12.3
Washington, D. C.	10.2	10.7	4.5	11.3
Danville, Va.	11.65	12.15	6.5	12.55
Norfolk, Va.	10.45	10.95	6.5	12.3
Petersburg, Va.	10.75	11.25	6.5	13.3
Richmond, Va.	10.75	11.25	6.5	13.3
Roanoke, Va.	11.95	12.45	6.5	12.8
Charleston, W. Va.	12.25	12.75	6.5	13.6
Parkersburg, W. Va.	11.55	12.05	6.5	13.3
Wheeling, W. Va.	11.55	12.05	6.5	13.9
Charlotte, N. C.	12.1	12.6	7.5	11.6
Hickory, N. C.	12.65	13.15	7.5	12.6
Mt. Airy, N. C.	12.5	13.0	7.5	11.8
Raleigh, N. C.	11.85	12.35	7.5	12.6
Salisbury, N. C.	12.15	12.65	7.5	13.0
Charleston, S. C.	10.95	11.45	7.5	....
Columbia, S. C.	11.8	12.3	7.5	....
Spartanburg, S. C.	12.5	13.0	7.5	....

	Mineral Spirits T.W.	V.M.&P. T.W.
Newark, N. J.	13	14.5
Baltimore, Md.	15.5	....
Washington, D. C.	15.5	....

Fuel Oils—T.W.	No. 1	No. 2	No. 3
Atlantic City, N. J.	10	9	9
Newark	10	9	9
Annapolis, Md.	...	...	...
Baltimore	9.8	9	9
Washington, D. C.	10.3	9.4	9.4
Norfolk, Va.	10	8.8	8.8
Petersburg	10.3	9	...
Richmond	10.3	9	9
Charlotte, N. C.	10.6	10.4	...
Hickory, N. C.	....	10	...
Raleigh	11.6	10.1	...
Charleston, S. C.	....	9	...
Columbia	....	10	...
Spartanburg	....	10.8	...

*Effective Aug. 5, '42 minimum retail resale price of 14.2c posted thru New Jersey.

Discounts:

Esso gasoline—to undivided dealers, 0.5c off dealer t.w.

Kerosine—1c off t.w. price for 25 gals. or more, under contract thru territory (Baltimore city contract not necessary) except no discount in state of New Jersey.

Naphthas—To buyers taking following quantities at one time: Newark, 2c per gal. on 200 gals. or more, less than 200 gals. 0.5c higher price; Baltimore, 2c off on 25 to 100 gals. and 3c on over 100 gals.; Washington, 2c off to contract buyers.

(N.B. Prices are Continental's "structural" prices. Prices do not reflect temporary reductions made to meet local competition.)

Notice

These prices include inspection fees on both gasoline and kerosine unless otherwise specified per gallon as follows:

Ala. 1/40c on gasoline, 1/2c on kerosine; Ark. 1/20c; Fl. 1/8c; Ill. 3/100c; Ind. 1/5c in lots of 25 bbls. or less, 2/25c in lots of more than 25 bbls.; Kans. 1/50c; La. 1/32c; Minn. 7/200c; Mis. 1/50c; Neb. 3/100c; Nev. gasoline 1/20c; N. C. 1/4c; N. Da. 1/20c; Okla. 2/25c; S. Car. 1/8c; S. Da. 1/20c; Tenn. 2/5c: and Wisc. 3/100c.

Kerosine inspection fees only: Iowa 3/50c; Mich. 1/5c per gal.

CONT'L OIL

	Conoco Bronz-z-a (*Reg*) †Tank Wagon	Demand (*3rd Grade*) Wagon	Gasoline Taxes	Kerosine T.W.
Denver, Col.	11	10	5.5	11
Grand Junc., Col.	12.5	11.5	5.5	12.5
Pueblo, Col.	10.5	9.5	5.5	10.5
Casper, Wyo.	11.5	10.5	5.5	12
Cheyenne, Wyo.	11	10	5.5	11.5
Billings, Mont.	12.5	11.5	6.5	12.5
Butte, Mont.	13.5	12.5	6.5	13.5
Great Falls, Mont.	12.5	11.5	6.5	12.5
Helena, Mont.	13	12	6.5	13
Salt Lake City, Utah	13.5	12.5	5.5	14.5
Boise, Ida.	14.1	13.1	6.5	16.5
Twin Falls, Ida.	15.6	14.6	6.5	17
Albuquerque, N. M.	10	9	*7	9.5
Roswell, N. M.	9.5	8.5	*7	9
Santa Fe, N. M.	10.5	9.5	*7.5	10
Ft. Smith, Ark.	9.5	9.25	*7	9.5
Texarkana, Ark.	9	8	*5.5	9
Muskogee, Okla.	9.5	8.5	7	8.5
Oklahoma City, Okla.	9.5	8.5	7	8.5
Tulsa, Okla.	9.5	8.5	7	8.5

*Taxes: In gasoline tax column are included these city taxes—Albuquerque, & Roswell, 0.5c, Santa Fe, 1c. Texas 4c state tax applies within city limits of Texarkana, Ark.; Okla. 5.5c state applies within city limits of Ft. Smith, Ark.

†To consumers & Dealers.

S. O. NEB.

	(*Regular Grade*) T.W.	Dealer	Gasoline Taxes	Kerosine T.W.
Omaha	11.4	9.6	6.5	10.1
McCook	12.0	10.1	6.5	10.5
Norfolk	11.9	10.4	6.5	10.6
North Platte	12.2	10.6	6.5	11
Scottsbluff	12.9	10.2	6.5	10.5

Standard Gasoline (*Regular Grade*)
Flight Gasoline (*Third Grade*)

S. O. CAL.

	Standard Posted Net Tank Truck	Standard Posted Retail	Flight Posted Net Tank Truck	Flight Posted Retail	Gasoline Taxes
San Francisco, Cal.	10	14	9	12	4.5
Los Angeles, Cal.	9.5	13.5	8.5	11.5	4.5
Fresno, Cal.	11	15	10	13	4.5
Phoenix, Ariz.	12	16	10	13	6.5
Reno, Nev.	12	16	11	14	5.5
Portland, Ore.	10.5	14.5	9.5	12.5	6.5
Seattle, Wash.	10.5	14.5	9.5	12.5	6.5
Spokane, Wash.	12.5	16.5	11.5	14.5	6.5
Tacoma, Wash.	10.5	14.5	9.5	12.5	6.5

Std. Aviation 73

	Posted Net Tank Truck	Gasoline Taxes	Kerosine Tank Truck
San Francisco, Cal.	12.5	4.5	11.5
Los Angeles, Cal.	12	4.5	10
Fresno, Cal.	13.5	4.5	12.5
Phoenix, Ariz.	14.5	6.5	12.5
Reno, Nev.	14.5	5.5	13.5
Portland, Ore.	13	6.5	13.8
Seattle, Wash.	13	6.5	13.8
Spokane, Wash.	16	6.5	16.8
Tacoma, Wash.	13	6.5	13.8

Resale & Commercial: T.C. deliveries 0.25c per gal. off posted net tank truck.

Commercial: Retail deliveries, and/or tank truck deliveries of less than 40 gals., 4c per gal. above posted net tank truck price for Standard Aviation and Standard Gasoline, and 3c per gal. above posted net tank truck for Flight Gasoline, except single deliveries of less than 40 gals. to Marine trade only, which are billed at posted net tank truck price.

TEXAS CO.

	Gasoline—Dealer T.W. Fire-Chief (*Regular*)	Indian (*3rd Grade*)	Gasoline Taxes
Dallas, Tex.	7.5	6.5	5.5
Ft. Worth, Tex.	7.5	6.5	5.5
Wichita Falls, Tex	8.5	7.5	5.5
Amarillo, Tex.	8.5	7.5	5.5
Tyler, Tex.	8.5	7.5	5.5
El Paso, Tex.	11	10.5	5.5
San Angelo, Tex.	8.5	7.5	5.5
Waco, Tex.	8.5*	7*	5.5
Austin, Tex.	8.5	7.5	5.5
Houston, Tex.	8.5	7.5	5.5
San Antonio, Tex.	8.5	7.5	5.5
Port Arthur, Tex.	8.5	7.5	5.5

*Less 1c temporary allowance to all dealers.

(Continued on next page)

Tank Wagon Prices—Continued

S. O. IND.

Red Crown (*Regular Grade*)
Blue Crown (*Third Grade*)

	Red Crown Dealer Prices		Gasoline Taxes	Kerosine T.W.
	Cons. T.W.	Blue Crown		
Chicago, Ill.	11.6	9.6	9.1	4.5	10.6
Decatur, Ill.	11.6	9.6	8.7	4.5	10.3
Joliet, Ill.	11.9	10.3	9.2	4.5	10.6
Peoria, Ill.	11.7	9.9	9.7	4.5	10.4
Indianapolis, Ind.	11.6	10.1	9.6	5.5	10.1
Evansville, Ind.	11.4	9.9	8.6	5.5	9.9
South Bend, Ind.	12	10.5	10	5.5	10.5
Detroit, Mich.	11.4	9.9	9.4	4.5	10
Grand Rapids, Mich.	11.4	9.9	9.4	4.5	9.9
Saginaw, Mich.	11.4	9.9	9.4	4.5	9.9
Green Bay, Wis.	12.2	10.7	10.2	5.5	10.9
Milwaukee, Wis.	12.1	10.6	10.1	5.5	10.8
La Crosse, Wis.	11.9	10.4	9.9	5.5	10.6
Minneapolis - St. Paul	11.9	10.4	9.9	5.5	10.6
Duluth, Minn.	12.2	10.7	10.2	5.5	10.9
Mankato, Minn.	11.9	10.4	9.9	5.5	10.6
Des Moines, Ia.	11.4	9.9	9.4	4.5	*10.1
Mason City, Ia.	11.7	10.2	9.7	4.5	*10.4
St. Louis, Mo.	11.0	9.5	9.3	*4.5	10.1
Kansas City, Mo.	11.0	9.5	8.6	*4.5	9.7
St. Joseph, Mo.	11.2	9.7	9.2	*4.5	9.9
Fargo, N. D.	12.9	11.4	10.9	5.5	11.6
Huron, S. D.	12.3	10.8	10.3	5.5	11
Wichita, Kans.	10.3	8.8	7.2	4.5	9.0

Stanavo Aviation 73 Octane
Withdrawn Jan. 1, 1944.

	Oleum Spirits	V.M.&P. Naphtha	Stanisol	*Taxes
(Prices are base prices before discounts)				
Chicago	13.5	13.8	12.8	4.5
Detroit	15.8	15	16.3	4.5
K. C., Mo.	13.3	14.3	13.8	1.5
St. Louis, Mo.	13.7	14.7	13.2	1.5
Milwaukee	14.4	15.4	14.9	5.5
Minneap'lis	14.2	15.2	13.5	5.5

Fuel Oils T.W.
Chicago

	Standard Heater Oil
1-99 gals.	9.3
100-149 gals.	8.3
150 gals. & over	7.8

	Stanolex Furnace Oil
1-99 gals.	8.8
100-149 gals.	7.8
150-399 gals.	7.8
400 gals. & over	7.3

	Stanolex Fuel A
1-749 gals.	6.5
750 gals. & over	5.75

	Stanolex Fuel C
1-749 gals.	6.0
750 gals. & over	5.25

Other Points Indianapolis	Stanolex Furnace Oil
1-99 gals.	9.0
100 gals. & over	8.0
Detroit	
1-99 gals.	8.7
100 gals. & over	7.7
Milwaukee	
1-99 gals.	9.0
100 gals. & over	8.0
Minneapolis	
1-99 gals.	9.1
100 gals & over	8.1
St. Louis	
1-99 gals.	8.4
100 gals. & over	7.4
Kansas City	
1-99 gals.	8.1
100 gals. & over	7.1

*Taxes: In gasoline tax column are included these city taxes—Kansas City, St. Joseph and St. Louis, 1c. Iowa kerosine prices are ex 3c state tax. In naphtha tax column are included 1.5c federal tax and state taxes.

State sales, occupation, consumer and use taxes to be added when applicable.

HUMBLE OIL

Humble Motor Fuel (*Regular Grade*)

	Thriftane Humble *Tank Wagon	Re-tail	(*Third Grade*) Thriftane *Tank Wagon	Re-tail	Gasoline Taxes
Dallas, Tex.	7.5	10.5	6.5	10.5	5.5
Ft. Worth, Tex	6.5	9.5	6	7.5	5.5
Houston, Tex.	8.5	12.5	7.5	10.5	5.5
San Ant., Tex.	8.5	12.5	7.5	10.5	5.5

	Kerosine *Tank Wagon	Retail
Dallas, Tex.	7	10
Ft. Worth, Tex.	7	11
Houston, Tex.	8	11
San Antonio, Tex.	7	10

	73 Oct. Aviation Gasoline Tank Car
FOB Baytown, Tex.	8.5

*To all classes of dealers & consumers.

Fuel oils—Statewide prices are for t.w. & drum deliveries of 50 gals. or more; prices for deliveries of less than 50 gals. are 0.5c higher. Cleveland Division assumed the state-wide fuel oil tank wagon prices on Nos. 1, 2 and 3 fuel oil, effective May 10. However the price of 7.55c per gallon and No. 4 fuel oil (full compartment hose dumps only) will remain as heretofore, in Cleveland Division.

Naphthas—to contract consumers off t.w. prices—Statewide: 300 to 999 gals., 0.5c; 1000 to 2499 gals., 0.75c; 2500 to 4999 gals., 1c; 5000 or more gals., 1.5c. Lucas County: Less than 50 gals., tank wagon price, 50 to 249 gals., 0.5c; 250 to 499 gals., 1c; 500 gals. or over, 1.5c.

S. O. OHIO

*Sohio X-70 Gasoline (*Regular Grade*)

	Consumer T.W.	**Resellers	Gasoline ‡S.S. Taxes	†Kerosine T.W.
Ohio, Statewide	12	10	13.5	5.5	9.3
Akron	12	9.5	12.5	5.5	9.3
Cincinnati	12	9.5	12.5	5.5	9.3
Cleveland	12	9.5	12.5	5.5	9.3
Columbus	12	9.5	12.5	5.5	9.3
Dayton	12	9.5	12.5	5.5	9.3
Marietta	12	9.5	12.5	5.5	9.3
Portsmouth	12	9.5	12.5	5.5	9.3
Toledo	12	9.5	12.5	5.5	9.3
Youngstown	12	9.5	12.5	5.5	9.3

Aviation Gasoline—Statewide

	Consumer Gasoline T.W.	Taxes
Sohio Aviation Gasoline clear Spec. AN-F-22	14.5	5.5
Esso Ethyl Aviation 73 Oct.	15.5	5.5
Esso Ethyl Aviation 80 Oct.	16.5	5.5
Esso Ethyl Aviation 87 Oct.	17.5	5.5
Esso Ethyl Aviation 91 Oct.	17.5	5.5
Esso Ethyl Aviation 100 Oct.	26.5	5.5

	†Naphtha—T.W. Statewide	Lucas County
S. R. Solvent	13.5	13.5
D. C. Naphtha	14.5	14.25
V.M.&P. Naphtha	14.5	14.25
Varnolene	14.5	14.25
Sohio Solvent	14.5	14.25

Fuel Oils—T.W.	No. 1	No. 2	No. 3	No. 4
Ohio, Statewide	8.3	8.3	7.8	*7.55

*Renown (third-grade) prices are same as X-70 unless otherwise noted.

**Except authorized agents.

†Kerosine prices are ex 1c state tax. Naphtha prices are ex 1.5c federal & 4c state tax.

‡Prices at company-operated stations.

††Statewide prices are subject to exceptions other than those shown.

Discounts:

Esso aviation—on contract to hangar operators and resellers, 2c off consumer t.w.

*For Cleveland area only.

Canada

PRICES OF IMPERIAL OIL, LTD.

Per Imperial Gallon, which is 1.2 U. S. Gallons

IMPERIAL OIL

3-Star Imperial Gasoline (*Regular Grade*)

	†Gasoline T.W.	*Gasoline Taxes	†Kerosine T.W.
Hamilton, Ont.	17.5	11	18
Toronto, Ont.	17.5	11	18
Brandon, Man.	21	10	23
Winnipeg, Man.	20.5	10	22.5
Regina, Sask.	18	10	20
Saskatoon, Sask.	20.8	10	22.8
Edmonton, Alta.	18.9	10	20.9
Calgary, Alta.	16	10	18
Vancouver, B. C.	15	10	24
Montreal, Que.	17	11	17.5
St. John, N. B.	16.5	13	19
Halifax, N. S.	16.5	13	19

*Includes 3c Federal, and Provincial taxes.
To divided & undivided dealers.
Absorption Gasoline—No. 26 R.V.P.—$2.28.

ATLANTIC REFINING

Atlantic White Flash (*Regular Grade*)

	Commercial T.W.	Dealer T.W.	Gasoline Taxes	Kerosine T.W.
Philadelphia, Pa.	10.2	10.7	5.5	12.25
Pittsburgh	10.7	11.2	5.5	12.6
Allentown	10.7	11.2	5.5	12.6
Erie	10.7	11.2	5.5	12.6
Scranton	10.7	11.2	5.5	12.6
Altoona	10.7	11.2	5.5	12.6
Emporium	10.7	11.2	5.5	12.6
Indiana	10.7	11.2	5.5	12.6
Uniontown	10.7	11.2	5.5	12.6
Harrisburg	10.7	11.2	5.5	12.6
Williamsport	10.7	11.2	5.5	12.6
Dover, Del.	....	11.2	5.5	12.6
Wilmington, Del.	....	10.7	5.5	12.1
Boston, Mass.	....	10.9	5.5	....
Springfield, Mass.	....	11.8	4.5	....
Worcester, Mass.	....	11.5	4.5	....
Fall River, Mass.	....	11	4.5	....
Hartford, Conn.	....	11.6	4.5	....
New Haven, Conn.	....	11	4.5	....
Providence, R. I.	....	11	4.5	....
Atlantic City, N. J.	....	10.7	4.5	10
Camden, N. J.	....	10.7	4.5	10
Trenton, N. J.	....	10.7	4.5	10
Annapolis, Md.	....	11.05	5.5	10.8
Baltimore, Md.	....	10.45	5.5	9.8
Hagerstown, Md.	....	11.55	5.5	10.3
Richmond, Va.	....	11.25	6.5	12.3
Wilmington, N. C.	....	11.55	7.5	11.9
Brunswick, Ga.	....	10.4	7.5	11.1
Jacksonville, Fla.	....	10.4	8.5	12.1

	Mineral Spirits T.W.†	V.M.&P. T.W.†
Philadelphia, Pa.	11	12.5
Lancaster, Pa.	12	13.5
Pittsburgh, Pa.	12.5	13.5

Fuel Oils—T.W.

	1	2	3	5	6*
Phila., Pa.	10.1	9	9	5.76	5.04*
Allentown, Pa.	10.6	9.3	9.3	....	....
Wilmington, Del.	10.1	9	9	....	....
Springfield, Mass.	10.2	9.4	9.4	....	....
Worcester, Mass.	10.2	9.3	9.3	....	....
Hartford, Conn.	10.5	9.2	9.2	....	....

‡Does not include 1c Georgia kerosine tax.

†Mineral Spirits prices also apply to Stoddard Solvent; V.M.&P. prices also apply to Light Cleaners Naphtha.
Discounts:

Gasoline—to undivided dealers, 0.5c off dealer t.w. except Georgia & Florida dealer t.w. and undivided dealer t.w. prices are same.

Kerosine—Thru Penna. & Delaware, 2c off t.w. price on t.w. deliveries of 25 gals. or more at one time.

*Residual fuel 13.0-15.9 gravity effective 10/17/43.

S. O. KY.

Crown Gasoline (*Regular*)
Standard (*Third Grade*)

	†Net Crown	Dealer Standard	Gasoline Taxes	Kerosine T.W.
Covington, Ky.	9.5	...	6.5	9.3
Lexington, Ky.	10.5	...	6.5	9.3
Louisville, Ky.	10	...	6.5	8.8
Paducah, Ky.	10	...	6.5	8.8
Jackson, Miss.	10	..	7.5	*9
Vicksburg, Miss.	9.5	...	7.5	*8.5
Birmingham, Ala.	10	...	*8.5	9
Mobile, Ala.	9	...	*9.5	9.5
Montgomery, Ala.	10	...	*9.5	10
Atlanta, Ga.	11.4	...	7.5	*12.1
Augusta, Ga.	11.4	...	7.5	*11.6
Macon, Ga.	11.4	...	7.5	12.1
Savannah, Ga.	10.4	...	7.5	11.1
Jacksonville, Fla.	10.4	...	8.5	10.1
Miami, Fla.	10.4	...	8.5	10.1
Pensacola, Fla.	9	8	*9.5	8
Tampa, Fla.	10.4	...	8.5	10.1

*Taxes: In tax column are included these city and county gasoline taxes: Mobile, 2c city; Birmingham, 1c city; Montgomery, 1c city and 1c county; Pensacola, 1c city. Georgia and Montgomery, Ala. have 1c kerosine tax, Mississippi 0.5c, not included in above prices.
†Consumer t.w. prices are same as net dealer prices.

S. O. LA.

Esso Gasoline (*Regular Grade*)

	Consumer Tank Wagon	Dealer T.W.	Gasoline Taxes	Kerosine T.W.
New Orleans, La.	8.75	9.25	8.5	*9
Baton Rouge, La.	8.75	9.25	8.5	*9.5
Alexandria, La.	8.75	9.25	8.5	*9.5
Lafayette, La.	9	9.5	8.5	*9
Lake Charles, La.	9	9.5	8.5	*11
Shreveport, La.	8.5	9	8.5	*8
Knoxville, Tenn.	10.5	11	8.5	12.5
Memphis, Tenn.	8.90	9.40	8.5	10.5
Chattanooga, Tenn.	10.5	11	8.5	11
Nashville, Tenn.	10.5	11	8.5	10
Bristol, Tenn.	10.95	11.45	8.5	13.1
Little Rock, Ark.	9.5	10	8	10

*Louisiana kerosine prices are ex 1c state tax
Discounts:

Esso Gasoline—To undivided dealers, 0.5c off dealer t.w.

(Continued on next page)

Seaboard Export Coastwise Prices

Atlantic Coast

(Prices are of refiners, FOB their refineries & their tanker terminals, & of tanker terminal operators FOB their terminals)—Prices in Effect June 5.

MOTOR GASOLINE

District	72 Oct. (ASTM)	68-70 Oct. (ASTM)
N. Y. Harb.	9.2 – 9.4	9.2 (1)
N. Y. Harb., barges	9.1 – 9.3	9.1 (1)
Albany	9.3 – 9.4	....
Philadelphia	9.2	....
Baltimore	8.95	8.85 (1)
Norfolk	8.7 – 8.95	8.45 (1)
Wilmington, N. C.	8.7 – 8.75	8.45 (1)
Charleston	8.7 – 8.8	8.1 (1)
Savannah	8.25 – 8.27	....
Jacksonville	8.27 – 8.275	....
Miami	8.27–8.275(2)	....
Tampa	8.27 – 8.4	8.275 (1)
Pensacola	7 – 7.2 (1)	....
Mobile	6.62 – 7.2	....
New Orleans	6.125– 6.375	....
Portland	9.5 – 9.65	....
Boston	9.4	....
Providence	9.4	....

FUEL OILS

District	KEROSINE and /or NO. 1 FUEL	No. 2	No. 3	No. 5	No. 6
N. Y. Harb.	7.1	6.7	6.7	$1.95–$2.01 (a)	$1.65 –$2.07
N. Y. Harb., barges	7	6.6	6.6	....	....
Albany	7.3	6.8	6.8 (2)	....	$1.85–$2.27 (1)
Philadelphia	7.2	6.7	6.7	$1.98	$1.65 –$2.07
Baltimore	7.2	6.7	6.7	....	$1.65 –$2.07
Norfolk	7.1	6.7	6.7 (1)	....	$1.65–$2.07 (2)
Wilmington, N. C.	7.05	6.7	....	....	....
Charleston	7.2	6.7 (2)	....	....	$1.60–$2.02 (2)
Savannah	7.05	6.25 (1)	....	....	$1.60–$2.02 (1)
Jacksonville	7.05	6.25	....	....	$1.60–$2.02 (1)
Miami	7.05	6.25 (1)	....	....	....
Tampa	7.05	6.25 (2)	....	....	$1.50–$1.92 (2)
Pensacola	4.8 (1)	....	....	....	....
Mobile	4.75 (2)	....	....	....	....
New Orleans	4.25 – 4.75	3.75 (2)	....	$1.27 (1)	$0.85–$1.27 (2)
Portland	7.3	6.8	6.8 (2)	....	$1.65–$2.07 (1)
Boston	7.2	6.7	6.7 (2)	$1.95–$2.07 (1)	$1.65 –$2.07
Providence	7.2	6.7	6.7 (2)	$1.90 (1)	$1.65 –$2.07

(a) This price is for straight-run low pour test No. 5 fuel.

Pacific Export

In Ship's Bunkers, or deep tank lots:

Prices in Effect	June 5	May 29
Diesel Fuel, Pac. Spec. 200	$1.45	$1.45
Grade C fuel, Pac. Spec. 400	$1.10	$1.10

Tank Wagon Prices (Continued)

SOCONY VACUUM

	Socony Mobilgas (*Regular Grade*) Com. Cons. T.W.	Indiv. Dr. T.W.	Gasoline Taxes
New York City			
Manhattan & Bronx	10.1	10.6	*5.5
Kings & Queens	10.1	10.6	*5.5
Richmond	9.7	10.2	*5.5
Albany, N. Y.	9.9	10.4	5.5
Binghamton, N. Y.	11	11.5	5.5
Buffalo	10.2	10.7	5.5
Jamestown, N. Y.	10.4	10.9	5.5
Mt. Vernon, N. Y.	10.1	10.6	5.5
Plattsburg, N. Y.	11	11.5	5.5
Rochester, N. Y.	10.8	11.3	5.5
Syracuse, N. Y.	10.5	11	4.5
Bridgeport, Conn.	10	10.5	4.5
Danbury, Conn.	10.5	11	4.5
Hartford, Conn.	10.6	11.1	4.5
New Haven, Conn.	10	10.5	4.5
Bangor, Me.	10.7	11.2	5.5
Portland, Me.	10.3	10.8	5.5
Boston, Mass.	9.9	10.4	4.5
Concord, N. H.	11.4	11.9	5.5
Lancaster, N. H.	12	12.5	5.5
Manchester, N. H.	11.3	11.8	5.5
Providence, R. I.	10	10.5	4.5
Burlington, Vt.	10.9	11.4	5.5
Rutland, Vt.	11	11.5	5.5

	Mineral Spirits T.W.	V.M.&P. Naphtha T.W.
Buffalo, N. Y.	12.4	13.6
New York City	11	12
Rochester, N. Y.	13.2	14.4
Syracuse, N. Y.	14	....
Boston, Mass.	12	13
Bridgeport, Conn.	†16.3	†17.3
Hartford, Conn.	†16.3	†17.3
Providence, R. I.	13	14

	Kerosine Yard	Kerosine T.W.	Mobilfuel Diesel T.C.	Mobilfuel Diesel T.W.	Mobilheat Fuel Yard	Mobilheat Fuel T.W.
New York:						
Manhat'n & Bronx	7.5	10.3	...	9.3	7.1	9
Kings & Queens	7.5	10.3	...	9.3	7.1	9
Richmond	7.5	10.3	...	...	7.1	9.0
Albany	7.5	9.8	7	9.3	7	9
Binghamton	8.9	11.2	...	10.7	8.4	10.2
Buffalo	8.6	10.9	8	10.3	8.2	10
Jamestown	8.7	11	...	10.6	8.3	10
Mt. Vernon	7.6	10.3	...	9.4	7.2	9
Plattsburg	8.1	10.4	...	9.9	7.6	9.4
Rochester	8.7	11	7.9	10.2	7.9	9.7
Syracuse	8.5	10.8	7.8	10.1	7.8	9.6
Conn.:						
Bridgeport	7.8	10.3	...	....	7.4	9.0
Danbury	8.2	10.8	...	....	7.8	8.8
Hartford	8.0	10.5	...	9.5	7.4	9.2
New Haven	7.5	10.3	...	9.3	7.1	9.0
Maine:						
Bangor	7.9	10.2	7.4	9.7	7.4	9.1
Portland	7.5	10.2	7	9.3	7	9
Mass.:						
Boston	7.8	10.6	6.9	9.2	7.1	9
N. H.:						
Concord	8.4	10.7	...	....	8.2	10
Lancaster	9.5	11.8	...	....	9.2	11
Manchester	8.5	11.1	...	....	7.9	9.7
R. I.:						
Providence	7.6	9.9	6.9	9.2	7.1	8.9
Vermont:						
Burlington	8.1	10.4	7.5	9.8	7.5	9.2
Rutland	8.3	10.6	...	10	7.7	9.5

*Does not include 1% city sales tax applicable to price of gasoline (ex tax).

†In steel barrels.

Discounts: Diesel—On t.w. deliveries, 0.5c for at least 400 gals.; 1c for full tank truck.

	Bunker C Fuel Ships' bunkers (Ex Lighterage)	Diesel Oil Ships' bunkers (Ex Lighterage)	Diesel Oil Shore Plants	Gas House Gas Oil 28-34 Gravity
N. Y. Harbor	$1.65 –$2.07	$2.78	6.7–6.8 (2)	6.8 (2)
Albany	$1.85 –2.09(1)	$2.98 (1)	7 (1)	6.7 (1)
Philadelphia	$1.65 –$2.07	$2.78	....	....
Baltimore	$1.65 –$1.77	$2.78	6.7 (1)	6.7 (1)
Norfolk	$1.65 –$2.07	$2.78	6.7 (1)	6.7 (1)
Charleston	$1.60 –$2.02	$2.78 (2)	6.7 (1)	6.7 (1)
Savannah	$1.60-1.72(1&a)	$2.62 (1)	....	....
Jacksonville	$1.60–$2.02 (2)	$2.62 (2)	....	....
Tampa	$1.50 –$1.92	$2.62 (2)	....	....
New Orleans	$0.85–$1.27	$1.65 (1)	4 (1)	....
Portland	$1.65–$1.77	$2.86 (2)	7 (1)	6.9 (1)
Boston	$1.65–$1.77	$2.78	6.7 (2)	6.8 (2)
Providence	$1.65 –$2.07	$2.78 (2)	6.9 (1)	6.8 (1)

Residual fuel prices generally vary with A.P.I. specifications from range low for 9.9 & below degrees to range high for 25.0 & above.

Bunker "C" when from Navy storage at New York and Norfolk to W.A.S. ships .05c discount.

(a) This price retroactive to April 6.

Gulf Coast

Prices in Effect June 5

MOTOR GASOLINE	New Orleans & Lower Mississippi to Baton Rouge Tank Cars	New Orleans & Lower Mississippi to Baton Rouge Barge	Texas Gulf Coast South of New Orleans Tank Cars	Texas Gulf Coast South of New Orleans Barges	CARGOES Domestic & Export From all Gulf Ports
Leaded (oct. by ASTM)					
76 oct.	6.75	6.5 – 6.75	6.5 –6.75	6.75	6.75
72 oct.	6.125–6.375	5.75	5.75–6.5(a)	5.75	5.75
63-65 oct.	....	....	....	....	....
Unleaded 70 oct.	....	....	....	....	5.75
67-68 oct.	....	....	....	....	5.5
65 oct.	....	....	....	....	5.25
60 oct.	....	....	....	....	5
KEROSINE & LIGHT FUELS					
41-43 w.w. kero.	4.125–4.25	4.125	4.125– 4.25	4.125	4.125
42-44 w.w. kero.	....	....	4.125	4.125	4.125
No. 2 fuel oil	3.75	3.75	3.75 – 4	3.75	3.75
DIESEL & GAS OILS					
(In diesel index No.)					
Below 43 di.	....	....	....	....	....
43-47 di.	....	....	....	....	4
48-52 di.	4	4	4	....	4
53-57 di.	4.125	4.125	4.125	4.125	4.125
58 and above	4.25	4.25	4.25	....	4.25

(a) 5.75c for Dist. 1 and 6.5c for other districts.

HEAVY FUELS & BUNKER OILS In Cargoes (At all Gulf Ports) Heavy Diesels	In Ship's Bunkers (Ex-lighterage)
Below 28 API Grav.	$1.35
28 & above API Grav.	$1.65
Bunker C Oil... $0.85–$1.27	$0.85–$1.27

Above products in Truck Transports of 2,400 gal. and over ½c above Tank Car Prices.

NOTE—Prices for heavy fuels vary within the range given above according to gravity from 9.9 B grav. and below to 25 B and above.

Mid-Continent Lubes

(At Gulf; in packages, FAS.; in bulk, FOB terminals)

Prices in Effect June 5

	Steel Drums	Bulk
200 Vis. D 210 brt. stock	....	....
150 vis. D 210 brt. stock 0-10 p.p.	32.65(1&A)	24.8 (1)
10-25 p.p.	....	....
100 vis. D 210 brt. stock 0-10 p.p.	....	....
10-25 p.p.	....	....
200 vis. No. 3 col. neutral:		
0-10 p.p.	....	....

(A) FAS at New Orleans

Wax

(Melting points are AMP, 3° higher than EMP. Prices are FOB refinery and do not include bag, freight or export differentials).

Prices In Effect June 5

Crude Scale	New Orleans Export	N. Y. Domestic	N. Y. Export
124-6 Yellow	4.25(1)	....	4.25(1)
122-4 White.	....	4.25(2)	4.25(2)
124-6 White.	4.25(1)	4.25	4.25
Fully Refined:			
123-5	5.2(1)	5.2(2)	5.2(1)
125-7	5.2(1)	5.2(2)	5.2(1)
128-30	5.6(1)	5.6	5.6(1)
130-32	5.85(1)	5.85(2)	5.85(1)
133-5	6.15(1)	6.15	6.15(1)
135-7	6.4(1)	6.4(1)	6.4(1)

Naphtha

Prices In Effect June 5

	V.M.&P. Naphtha	Mineral Spirits
New York Harbor	11 (2)	10
Philadelphia dist.	11 (2)	10
Baltimore	10.5 (2)	9.5
Boston	11.5 (2)	10.5
Providence	11.5 (1)	10.5 (2)

WAR-OIL EQUIPMENT EXCHANGE

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For Sale

2585 gallon—2 compartment Butler trailer—1940 Ford tractor—New engine—4 brand new tires; all others in excellent condition. United Oil & Gas Co., Mount Union, Pa.

FOR SALE: Profitable jobbing business and franchise on farm tractors and equipment in central Wisconsin. Would require $15,000.00 capital. Reply National Petroleum News, Box No. 390.

FOR SALE: Independent petroleum jobber set-up with stations and several hundred farm accounts, ample equipment; operates three trucks. Located in Western Ohio. Write Box No. 396.

FOR SALE: Seven tank trucks. 1941 Chevrolet tractors with special transmissions and axles. 2500 gallon semi-trailer tanks insulated and steam coils for hauling hot asphalt. 9.00-20 tires on tanks and trucks, this equipment in first class condition and will sell one or all. Price $2,000.00 each. Wire or write A. J. White, 406 Standard Life Building, Jackson, Miss.

FOR SALE
STEEL TANKS
Three—3,000 gal., two—10,000 gal., three—12,000 gal.; nine—21,000 gal. Also miscellaneous tanks 280, 500, 1,000 and 2,000 gal.
Empire Equipment Corporation
608 Empire Bldg.
Cleveland 14, Ohio

FOR SALE

NOTICE: Can supply 200 grade three recapped tires per week. Write for price quotation, state quantity and sizes.

Lorain Avenue Tire Co.,
7982 Lorain Ave., Cleveland 2, Ohio
Phone: Woodbine 9745

FOR SALE
1—Chevrolet Truck with 600-gal. 3-compartment Quaker City tank complete with pump, hose, meter and reel. 1—600-gal. (3-compartment) and 1—700-gal. (2-compartment) Quaker City tanks—each with pump, meter and reel.
2000—30-gal. lubsters @ $5.00 ea. (as is).
J. P. Garr, 366 Prospect Ave., Hartford 5, Conn.

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"G I" 5-gallon gasoline cans. Inspected and condemned. No leaks. Ideal for farm trade and oil deliveries. Same gas can you see on Army jeeps and trucks, except are seconds.

Subject to prior sale. Send check with order. $2.00 each f.o.b. Chattanooga.

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Wanted to Buy

WANTED: 1—1200-1500 Gallon Modern Truck Tank 5 to 8 compartments. Can and Barrel racks preferred. Forward descriptions—pictures if possible, and price. Ross Independent Oil Company, Washington, Pa.

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Individual with twenty years partnership experience in master service stations and merchandise operations will lease or buy master service station properties. Describe location, size of property and improvements. State Terms.

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ADVERTISERS' INDEX

This index is published as a convenience to the reader. Every care is taken to make it accurate but National Petroleum News assumes no responsibility for errors or omissions.

American Flange & Mfg. Co. 23
American Oil Co. 19
Blackmer Pump Co. 49
Crown Can Co. 14
Erie Meter Systems, Inc. ..... Inside Front Cover
Ethyl Corporation 1
Fruehauf Trailer Co. 32-33
Gilbert & Barker Mfg. Co. ..... Outside Back Cover
Gulf Oil Corporation 25
Houdry Process Corporation 39
Kellogg Co., M. W. 29
Mack Mfg. Co. 37
Mayfair Hotel 53
Meyercord Co. 43
Milwaukee Valve Co. 47
National Powder Extinguisher Corp. 21
Pennsylvania Grade Crude Oil Association 45
Pennsylvania Rubber Co. 27
Philadelphia Valve Co. 41
Platt's War Oil Communication Services 55
Shell Oil Co. 35
Socony-Vacuum Oil Co. ..... Inside Back Cover
Westinghouse Electric & Mfg. Co. 17

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WRITE OR APPLY TO OUR RELATIONS DEPARTMENT, 200 Bush Street, San Francisco.

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Major oil company with continent-wide operations and research seeks graduate technical men of the following qualifications:

MECHANICAL ENGINEERS—with petroleum refinery or similar experience. Should be familiar with refinery design, estimating, construction, mechanical equipment, engineering materials, and utilities systems. Process knowledge desired although not essential.

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Work not of a temporary nature. In reply state experience, education, age, marital status, draft classification and salary expected, include small snapshot (not returnable). Replies strictly confidential. Applicants now employed at highest skill in war industries not solicited. Box No. 249, National Petroleum News, Cleveland, Ohio.

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National petroleum organization requires

services of man capable of contacting railroad executives. Knowledge of petroleum products or railroad experience desired. Mechanical engineering background preferred. Salary $4000 to $5000 yearly. Age about 40. Supply full details including age, schooling, employment record and draft status. If employed in essential war work, availability certificate required; if already working at your highest skill, do not apply. Box: 394.

ABOUT OIL PEOPLE

The honorary degree of Doctor of Science was conferred last week on **Dr. Thomas Midgley, Jr.**, by Ohio State University. Dr. Midgley is president of the American Chemical Society and vice president of the Ethyl Corp. Dr. Midgley was cited for his discovery of tetraethyl lead and other achievements in fuel research, which made possible dramatic advances in automotive and aircraft engines; for his development of non-toxic, non-inflammable refrigerants; for pioneering studies in rubber; for contributions to the extractions of bromine from the ocean, and for his fostering of the spirit of research.

° ° °

Two new district offices have been opened by the White Star division of Socony-Vacuum Oil Co., **Henry J. Muller,** sales manager announces. These will be at Flint, Mich., with **Arthur T. Keselring** in charge, and at Columbus, Ohio, with **C. O. Humker** as district manager.

At the same time Mr. Muller announced several promotions in the Michigan and Ohio organizations. These include the appointment of **John M. McCollough,** formerly Eastern district manager, to the position of regional automotive sales manager for the state of Michigan, and **Marcel A. Baur,** formerly Cincinnati district manager, who becomes regional automotive sales manager for Ohio. These men will report to **George Willoughby,** automotive sales manager for both Michigan and Ohio.

R. R. Lapp, formerly assistant to Mr. Baur at Cincinnati, steps up to the position of Cincinnati district manager with **T. C. Kase** as his assistant.

° ° °

William Wiley Rice, manager of Deep Rock's wholesale department, has been away from his office for some time, since what started out as "just a cold" has developed into pneumonia with complications. He is at home recovering at present.

° ° °

L. E. Tustison, formerly chief accountant in the Carter Oil Co.'s Tulsa offices, has been transferred to the Northwest Division office in Billings, Mont., where he will be chief accountant in the manufacturing and marketing department.

° ° °

Among those receiving Standard of New Jersey 10-year service awards recently were **J. R. McWilliams,** vice-president and manager of the Northwest Division, Billings, Mont.; **Reese A. Poynter,** production superintendent, Cut Bank, Mont.; **Raymond D. Sloan,** supervisor of scouting and statistics division of the exploration department, Tulsa office, all of the Carter Oil Co.

° ° °

Divots will fly, counting will become a science, and the complexities of the oil business forgotten at the Lulu Country Club, Philadelphia, on June 13, **Fred E. Lond,** president of Murray Oil Product Co. tells NPN. The occasion is the spring golf game of the Oil Trades Assn. of Philadelphia, of which Mr. Lond was recently appointed chairman.

° ° °

O. A. Seager, assistant division manager of Carter Oil Co.'s Northwest Division, has been named assistant manager of the Standard Oil Company of Egypt, and will report soon to his headquarters in Cairo. Mr. Seager has been with Carter for 14 years, and previous to his appointment as assistant division manager last December he was division geologist in the Northwest Division for six years.

° ° °

Roland E. Skelton, formerly vice president of the Crown Oil Corp., Harrison, N. J., has organized the Skelton Petroleum Corp. at Delawanna, N. J. Mr. Skelton's new company is operating a bulk storage plant on the Passaic River at Delawanna.

° ° °

John R. Fitz-Hugh, formerly with the Standard Oil Company of Louisiana, has joined the staff of the Carter Oil Co. as co-ordinator of refining operations.

Promotion of **Cyrus S. Gentry,** formerly general counsel, to the position of vice president, was announced by Shell Oil Co., Inc., along with notification of promotion of three other Shell executives. Mr. Gentry will retain his position as secretary in addition to the new capacity of vice president. **E. Chester Peet,** formerly assistant treasurer, has been promoted to vice president and treasurer and **William H. Garbade,** formerly general auditor, will take his place as assistant treasurer. **John W. Watson,** treasurer, has been promoted to assistant treasurer of the Shell Union Oil Corp., and will assume responsibility for the treasury functions of Shell Chemical Co.

° ° °

Mary Morris was recently chosen by the Ingleside Humble Club to head the directorate for the year. This was the first time a woman has been chosen for that office.

° ° °

Receiving the congratulations of friends at the Engineers Club recently was **Glenver McConnell,** chief mechanical engineer at Midcontinent area, production department, Shell Oil Co., Inc., who is a newly elected member of Tulsa's school board.

Honor Driver for Perfect 15-Year Safety Record

Norman Carris in 15 years service with the Tide Water Associated Oil Co. has driven company trucks 526,581 miles through busy New York Streets without an accident. He was never late for work and never missed an hour because of illness. For his remarkable record Mr. Carris was honored recently at a testimonial luncheon attended by high company officials. In the photo above Mr. Carris, left, is receiving a $100 war bond from William F. Humphrey, company president. Mr. Carris, a World War I veteran, had two sons in World War II, both flying lieutenants in the Army.

LAZY BENCH

"Sam", depicted in an NPN feature on July 2, 1941, as a successful oil marketer in a typical non-defense rural area, Orrville, Ohio, was a recent visitor to our offices.

Lieut. Bohlen

But instead of being **Sam Bohlen,** oil man, oil association officer, civic leader and all around good fellow, our visitor was 1st Lieut. Sam Bohlen, whose address is a Pacific base, location a military secret.

Bronzed, beribboned, and with his 200 pounds completely redistributed, Sam is as much the soldier as he was an oil man when he enlisted two years ago. He has attained his present rank the hard way. Before enlisting, he was offered a commission. This he declined.

Sam got the affairs of his company, Snyder Oil Co., in as good shape as possible, married Ruth Gardner on June 3, 1942, and after a short wedding trip became Private Bohlen. He left Mrs. Bohlen, and his sister, Mrs. Gladys Tschantz, in charge of the company, along with most of the old personnel and they have been doing an outstanding job.

Lieut. Bohlen returned to the war zone on May 31. His chief concern for the future of the independent oil jobber, he told NPN, was the "menace" of the co-ops, which he termed "competition without taxation."

° ° °

Two Humble Oil men of the Baytown refinery, **Paul L. DeVerter** and **H. J. Corneil,** recently took a tour of undisclosed locations in the European and Near East war theater. They traveled approximately 45,000 miles by air in a few weeks.

Mr. DeVerter is head of the company's inspection lab in the laboratory division and Mr. Corneil is a member of the research group in the same division.

Mr. DeVerter was loaned to the War Department as an Army and Navy Petroleum Board representative for a special mission to North Africa, England and other points. He witnessed nine bombings in London. On one or two occasions he witnessed bomb hits "in a substantially close area."

° ° °

Ensign E. S. (Jack) Conway, who was formerly a sub-surface geologist for Carter Oil Co. at Seminole, Oklahoma, is now stationed on a Navy mine sweeper in the Pacific.

The shades of night were falling fast
When for a kiss he asked her
She must have answered yes because
The shades came down much faster

—Elsie F., Schenectady, N. Y.

° ° °

HOT WEATHER NOTE

One day when a lady opened her ice box she was amazed to find a rabbit sitting there looking at her with innocent pink eyes.

"What are you doing here", she said.

"Isn't this a Westinghouse", said the rabbitt.

"Yes it is" replied the surprised woman.

"Well", said the little rabbit, "I'm just westing".

—Hutch, the telephone gal.

° ° °

SHERMAN SAID IT, GIRLS!

Betty Gramtz of the Los Angeles Texaco office has a carton of NPN cigarets on the way to her Sergeant friend in the service, with an APO number, for this one:

Modern Maiden's Prayer: Dear Lord, please bring him home safe, sound and single.

° ° °

TOUGH ON THE PIGS

To a Hoosier gal goes candy for this "good earth" squib:

A farmer, who seemed to enjoy grumbling, had an extra fine crop of potatoes.

"Well, for once you must be pleased", said a neighbor. "Every one is talking about your fine potatoes this year."

"They're pretty good," admitted the farmer grudgingly, "but where are the bad ones for the pigs?"

C.R.D., Osgood, Ind.

° ° °

'ROUND AND 'ROUND

The stenographer, new on the job, just about wrecked the office looking for some round envelopes in which to mail circular letters.

M.L.H. of S. Dak.

° ° °

'NUFF SAID

A traveler connected with a cycle company was expecting a blessed event. Before going away he asked the nurse to wire "Gent's model arrived" if a boy came, "Lady's model" if a girl.

The wire he received staggered him. There was only one word, "Tandem."

M. M. B., New Hampshire

° ° °

WASHED UP!

Friend—"Ah thought your Mose was froze to that job in the shipyard?"

Mrs. Mose—"So did Mose. But he got to loafin' and dey done defrosted him."

Hazel Johnson—Lincoln, Neb.

NO DOUBT ABOUT IT

"The lazybench column always gives me a few hearty laughs. I enjoy it very much, and I know that after reading it I am in a much pleasanter humor. If my contribution should appear in the next issue, I am sure that I would have the pleasantest personality in the office for at least a week. Here is my entry:

"One of the superintelligent seniors entered the professor's office one morning, and in a very superior tone remarked: 'Last night, professor, your daughter accepted my proposal of marriage. Fully realizing the importance of the step, I have called to see you and inquire if there is any insanity in your family.'

"The old professor looked up over his glasses, surveyed the old man in silence for a moment, then sadly nodding his head murmured, 'Yes, yes, there must be.'"

Thanks, Marie Wallett of Chicago. Turn on that pleasant personality. We hope you enjoy that gorgeous box of candy which will reach you soon. Ed.

Oil Ladies

Send us material for the Lazybench. This can be jokes, poems, or actual happenings about oil men that would give others in the business a chuckle. Look over some of the back numbers and you will get the idea. Don't crib, and keep 'em clean. (Many oil executives use these as a preface to their dinner club speeches).

Mail as many as you wish to Lazybench Editor, 530 Penton Bldg., Cleveland 13, Ohio. No labels, can tops, coupons or solutions to puzzles necessary. We pay off for each contribution with candy for yourself, or cigarets for your friend in the service.

"MAKE MINE SCOTCH"

A seafaring man, medium-sized and not very imposing, dropped into a honky tonk on his night ashore and thumping his fist on the bar, roared, "When Gregory drinks, everybody drinks."

The bar was crowded; the house filled all the glasses and everybody drank, flourishing their tankards in Gregory's direction.

Then the sailor reached into his jeans, slapped a coin on the counter and roared again, "And when Gregory pays, everybody pays."

Mary Visca—Los Angeles

° ° °

NONSENSE DEPARTMENT

And there was the super-super-super salesman who sold a man with a Phi Beta Kappa key a double breasted suit.

Breh Rolyat

PLENTY OF "FLYING HORSEPOWER"

FOR POST-WAR MOBILGAS

Socony-Vacuum is Already Producing Enough Aviation Gasoline with Sensational New "Flying Horsepower" Ingredients

TO KEEP HUNDREDS OF 4-ENGINED BOMBERS FLYING DAILY BETWEEN ENGLAND AND GERMANY!

The Same Power Ingredients in Mobilgas will give cars New Quick Power Response under All Driving Conditions!

IT'S 100% War-Power now—but after Victory, Socony-Vacuum's 14 huge super-fuel refineries will be ready to supply "Flying Horsepower" for America's cars!

The same super-fuel ingredients which are now increasing the power output of U.S. aircraft engines will go into Mobilgas . . . will yield the same quick getaway and power-pull which are so important to our fliers.

"Flying Horsepower" is the result of an 11-year Catalytic Cracking Program by Socony-Vacuum, the greatest in the world! Today, Socony-Vacuum has *by far* the largest capacity in the industry for producing catalytically cracked gasoline.

Mobilgas
SOCONY-VACUUM

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Socony-Vacuum maintains many other conveniently located service offices to give you close and fast cooperation.

LOOK TO

Gilbarco

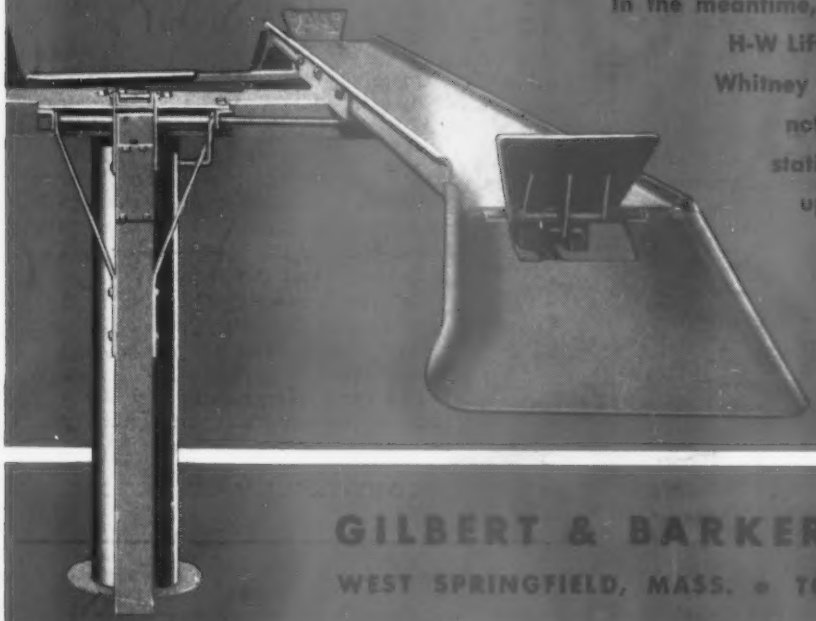
FOR

HOLLISTER-WHITNEY

SAFETY LIFTS

After the war the Hollister-Whitney Safety Lift will have a new name—the Gilbarco Lift—for Gilbert & Barker has acquired all rights to this highly efficient, widely known and respected service station lift.

In the meantime, Gilbarco will supply all parts for H-W Lifts now in service. From the Hollister-Whitney organization Gilbarco has acquired not only an outstanding piece of service station equipment but a tradition to live up to. It will be Gilbarco's policy to maintain that tradition to the highest degree.



GILBERT & BARKER MFG. CO.

WEST SPRINGFIELD, MASS. • TORONTO, CANADA

ARMY E NAVY

TECHNOLOGY DEPT:

NATIONAL PETROLEUM NEWS

Monthly Technical Section Devoted to

REFINERY MANAGEMENT *and* PETROLEUM CHEMICAL TECHNOLOGY

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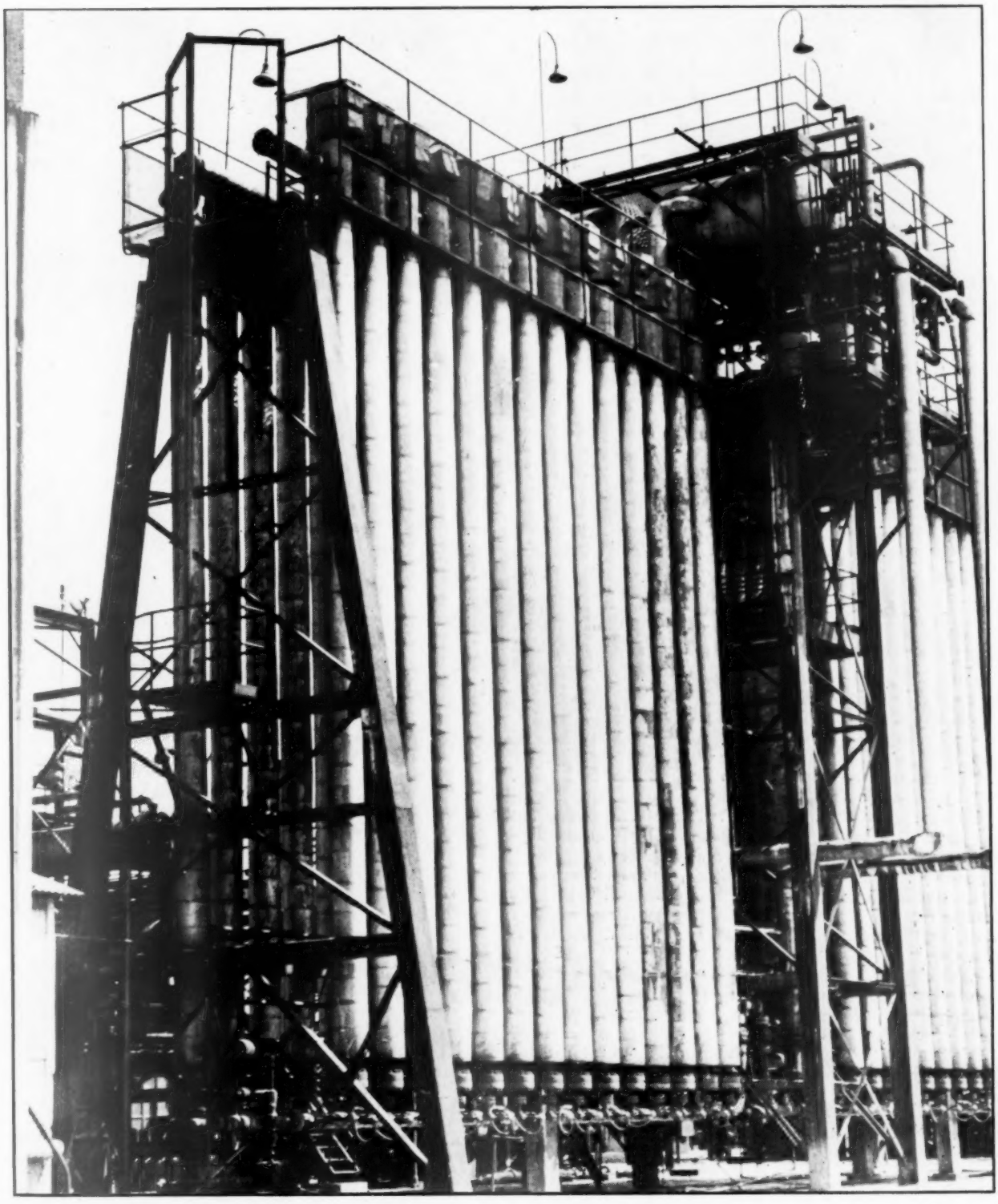
Section Two **June 7, 1944**



CATALYST TUBE BANKS IN CUMENE PLANT—Important additions to the supply of aviation gasoline were made possible by the use of cumene (isopropylbenzene) as a blending agent. By a process developed by Shell Oil Co. Inc. 19 units in refineries over the country were quickly converted to its manufacture. Shown in the photo are the 56, 40-ft. high pressure reaction tubes in the unit of Shell Oil Co. at its Wood River refinery, where propylene, a refinery byproduct, and benzene, a steel mill byproduct are alkylated to make cumene

Direct Work in the Petroleum Field Of Society of Automotive Engineers

John R. Sabina
S.A.E. Vice-President, Fuels and Lubricants Activity

ASSOCIATION with the petroleum industry started for John R. Sabina back in 1925, not long after his graduation from the University of Pennsylvania, when he joined the Atlantic Refining Co. as test engineer. He has been active for many years in research work in testing automotive fuels and lubricants, particularly fuels with regards to detonation.

In 1937 he left Atlantic to organize the Petroleum Chemicals Testing Laboratory for E. I. du Pont de Nemours & Co., to investigate the applicability of chemicals to the petroleum field and to develop additives for improving finished petroleum products. He is now manager of that laboratory.

Since war broke out, Mr. Sabina has been engaged in co-operative work with our armed services. His activities are directed principally toward solving fuel stability problems brought about by critical war requirements.

NOW research engineer at Esso Laboratories in Linden, N. J., Albert J. Blackwood has been associated with Standard Oil Development Co. since 1927. For several years he has been responsible for engine testing and laboratory development work on automotive, diesel and aviation fuels.

Prior to joining Standard's organization, he spent three years as instructor of experimental engineering at Cornell University, where he received his Mechanical Engineering degree and two years in experimental and testing work with Mack-International Motor Co.

Mr. Blackwood has been sole or co-author of more than a dozen technical papers presented before A.P.I. and S.A.E. meetings on subjects relating to properties and operating performance of fuels and lubricants. Currently he is chairman of S.A.E.'s Coordinating Fuel Research committee, studying motor fuel volatility projects.

Albert J. Blackwood
S.A.E. Vice-President, Diesel Engine Activity

REFINERY MANAGEMENT *and* PETROLEUM CHEMICAL TECHNOLOGY

June 7, 1944
Volume 36
Number 23

A MONTHLY TECHNICAL SECTION OF NATIONAL PETROLEUM NEWS *incorporating International Petroleum Technology*

Co-ordinated Maintenance Program Improves Units' On-Stream Time

Centralized Control System Established by Company With Six Refineries Proves Its Worth under Wartime Emergency Conditions of Materials and Labor Shortage

SAVINGS in maintenance costs and high operating efficiency of refinery units are achieved at The Pure Oil Co. by having the maintenance programs for all plants supervised by its central refinery board.

Pure's goal for its wartime operations is to have cracking units on stream 90% of the time. During 1943 some units operated at 30% over rated capacity.

Two chief benefits of this centralized supervision of maintenance are cited by the company. First, plant maintenance and new construction work can be closely correlated. Past operating records of units are studied whenever new installations of the same type are to be made, to see if certain maintenance trouble spots in the old units cannot be eliminated or at least lessened when the new units are designed. "Far-sighted design is necessary for efficient maintenance" is an axiom of the company's management.

Second, the refinery board is the first to know of contemplated changes in operating programs for the individual refinery. Thus the entire schedule for down-time and general maintenance work can be set up well in advance and still kept in line with the proposed operating program.

Other benefits of centralized supervision of maintenance work achieved by The Pure Oil Co. system, as recognized by other oil companies, are:

Down-time schedules can be arranged for all plants a year or more in advance, which aids the company in adhering to an even production program. If down-time can be planned ahead and schedules maintained, costly interruptions can be minimized. From $10,000 to as much as $50,000 worth of finished products can be lost each day a unit is down, company officials stated.

The purchasing department can be advised well in advance of required replacement and repair materials, so that parts can always be on the ground when needed. This advantage has been particularly helpful in licking the wartime shortages of certain materials.

The system for efficient plant maintenance as set up by The Pure Oil Co. both in its home office and the individual plants is described below.

Co-ordination of Maintenance with Other Operations Is Function of Centralized Board

Basic responsibility for seeing that each refinery's maintenance plans fit into the entire Pure Oil Co. program lies with the Refinery Control Board. This board is a centralized staff organization operating in the home office at Chicago and composed of key technical men from various departments. Officially, the name "Refinery Control Board" is regarded as a misnomer. The board actually exercises very little control, at least over the individual refineries. It serves primarily as an advisory group to the plants, not telling them what to do in the way of maintenance or how to do it, but rather giving them suggestions and advice from its long-term planning.

Although the board does have to approve all the major maintenance projects of the refineries, its basic function is to "coordinate all activities—development, construction, manufacture, maintenance—of the entire organization, directing them toward a common goal of increased efficiency".

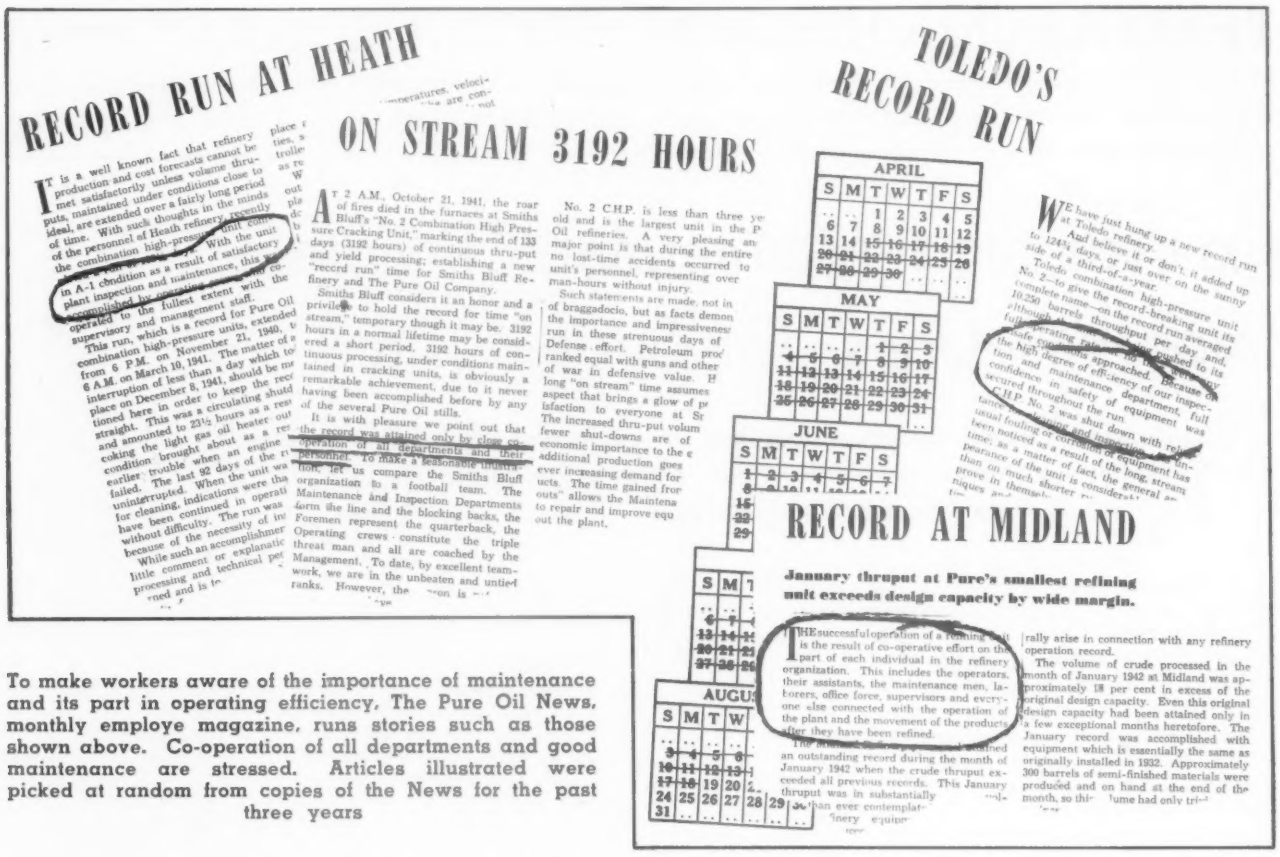
One case was cited as an example of how Pure's refinery board contributes to lowered plant maintenance costs. A fractionating tower at one of the refineries needed a complete new insulation job to keep it in efficient operation—a major maintenance project costing around $7000. As is usual with major maintenance jobs of this nature, the refinery submitted a request to the refinery board for approval to proceed with the work. Normally, the request would never have been questioned—the tower needed new insulation according to the inspector's report, and the refinery had fitted the work into its planned maintenance program as previously set up.

But there was one other point. The refinery board, because its members had their fingers on not only maintenance and manufacture but also new construction and the company's long range planning program, knew that within a year that particular tower would be abandoned. Consequently, it was able to recommend a temporary patching job which would be entirely serviceable for the balance of the unit's life. This patching cost only a few hundred dollars, instead of $7000 to reinsulate the tower entirely.

Board Approves Major Maintenance

All major maintenance projects come to the board for approval, primarily so that its members can keep posted on what is happening out in the field and apply that knowledge to the design and construction of new improved units. If they note that one particular piece of equipment is requiring considerable and continual maintenance, they will take steps to eliminate that trouble. If that is not possible, they'll alter the design of subsequent units so as to lessen maintenance costs of that particular design of equipment.

In addition, the board sets up the manufacturing forecasts for the different refineries, taking into account the maintenance requirements previously submitted by each refinery and the estimates of the sales department. Because its members are familiar with the entire operations of the company, they are able to alter these production schedules to meet individual maintenance emergencies which might arise. If they find that one particular unit will have to be shut down soon for some unanticipated maintenance, they either try to rearrange the maintenance schedule at the refinery so



RECORD RUN AT HEATH

ON STREAM 3192 HOURS

TOLEDO'S RECORD RUN

RECORD AT MIDLAND

January thruput at Pure's smallest refining unit exceeds design capacity by wide margin.

To make workers aware of the importance of maintenance and its part in operating efficiency, The Pure Oil News, monthly employe magazine, runs stories such as those shown above. Co-operation of all departments and good maintenance are stressed. Articles illustrated were picked at random from copies of the News for the past three years

as to be able to meet manufacturing needs, or alter the forecast. In some cases they may even alter the forecasts for another plant to offset the lost production at the one refinery.

This idea of a centralized staff organization or advisory board was first conceived at Pure about 20 years ago. At that time it was noted that the maintenance and construction departments were following somewhat parallel tracks, each duplicating the other's work in some areas and neither taking full advantage of the other's experience. It was decided then to set up a unified program for these two vital phases of the refining business, eliminating duplication and producing a smoother and more efficient organization.

The refinery board as it exists today is the result. The organization is a permanent one, with a full-time chairman (who might be classed as an assistant to the refinery manager). The board has separate offices of its own in the Chicago headquarters, and the clerical and stenographic help necessary to handle all its detail work. All clerical details of the group's operations, including the responsibility of keeping minutes of the regular board meetings, are handled by the chief clerk of the board.

Membership on the board includes all of the key technical men: Director of research and development, chief construction engineer, chief chemist, process technicians, maintenance engineer, combustion engineer, etc. Including the chairman, about a dozen people are on the board. This general scope of membership was decided upon as being most representative of the groups that are concerned with refinery operations.

One thing is evident about the entire Pure Oil organization—and that is that it doesn't depend a great deal upon titles. A man serves on the refinery board not because he holds a certain position but because he has something to offer which the board needs. The chief chemist is a member, but his assistant may also be asked to serve if he has knowledge about some particular phase of operations. It is common for the board chairman to call in junior members of one department or another if they are familiar with certain problems through field experience. In other words, no rigid, inflexible organization is set up. It is usually left to the chairman to decide if it is necessary to call upon additional members.

Managers of the individual refineries attend at least one meeting of the board during the year. They might also be asked to attend if some special problem concerning their plant is up for discussion.

Meetings are held twice a month, approximately on the 1st and 15th. In general, the board tries to hold meetings during the middle of the week, when the usual office work isn't quite so rushed and crowded. First meeting of the month is usually devoted to:

1—Review of past month's operations as compared with the forecast which had been prepared.

2—Review of forecast for current month's production, taking into account any changes necessitated because of unexpected maintenance requirements.

3—Preparation of production forecasts for coming month.

4—Review or discussion of operational difficulties and maintenance problems which have come up during the past month (e.g. products not meeting specification, or unusual corrosion experienced with certain crudes).

5—Future construction plans.

6—Future maintenance plans. (A 3-week shutdown at one plant may require months of preparation and preplanning of production so that a sufficient backlog of product can be stored up to take care of sales during the shutdown).

7—Research and development programs.

Second meeting of the month is usually taken up with discussions of special projects which the board has under consideration. These special projects include maintenance problems which are occurring too frequently, the possibilities of making a new product, or the advantages of converting certain units to a different type of production.

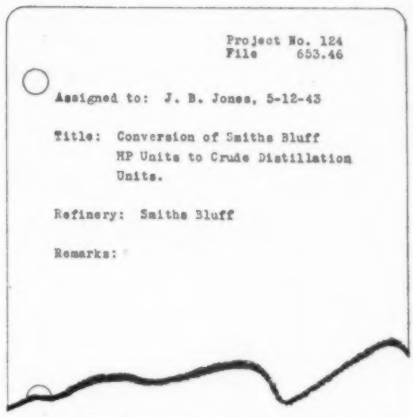
These items, as they come up, are first passed on by the chairman. Sometimes he can handle them very quickly, and no further action is necessary. One example might be a question concerning the possibility of converting a unit, which the board chairman could determine at a glance wouldn't be practical from a

mechanical viewpoint. In other cases they might be plausible and potentially profitable, although requiring further study and investigation. This would be true, for example, in considering the possibilities of making a new product, when such factors as type of crude available, plant facilities and transportation should all be studied.

In the cases involving investigation, the board chairman will set up a "project," assign a number to it, and designate one member of the board to take it "under his wing" and look into it. So that all members of the board will be familiar with the various projects up for consideration, a "project report" is typed up and distributed to each member (see Fig. 1).

Should some special emergency arise, such as a severe corrosion condition at one refinery, the chairman has the authority to call special meetings, which might be attended by only a few or all of the members, depending upon who was affected or concerned.

About the only maintenance work which the refinery board initiates is that involving large expenditures—the repair or replacing of major equipment. Board work in this classification is handled by the construction engineering department, the maintenance engineer of which is a member of the refinery board.



Project No. 124
File 653.46

Assigned to: J. B. Jones, 5-12-43

Title: Conversion of Smiths Bluff HP Units to Crude Distillation Units.

Refinery: Smiths Bluff

Remarks:

Fig. 1—To keep all board members informed of special problems being studied by the board, "project reports" such as shown above are distributed to them

Individual Refineries Are Responsible For Holding to Maintenance Schedules

Practically all of the maintenance work at the refineries—from 90 to 95% of it—is initiated and handled by the individual refinery maintenance foremen and inspectors. "We want them to feel that the maintenance of their own plants is entirely their responsibility. We're always glad to give them any assistance and to pass on suggestions, but our primary concern is to see merely that their maintenance plans tie in with the rest of the company's activities," said one company official.

Kingpin of the maintenance program at the individual refineries is the periodic inspection report. Whenever a unit is down, the inspection staff is on hand—first, to check over what repairs have to be done currently and to see that they are taken care of properly; second, to get some idea of what may have to be done in the future.

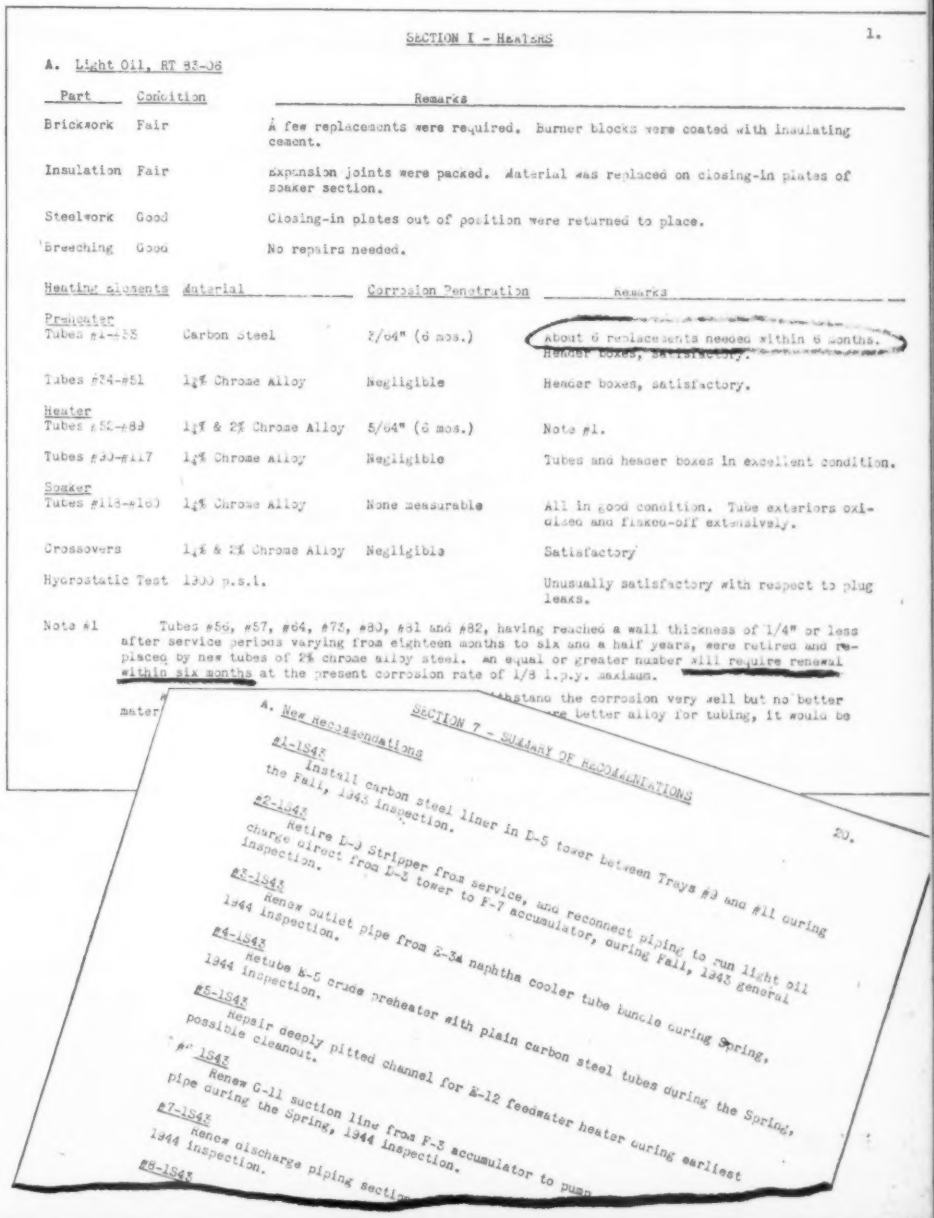
Following the general inspection, a detailed report of each section of the unit and the exact work performed on it is prepared by the chief inspector. Included is a summary of recommendations for major maintenance work to be done at some subsequent date. Fig. 2 shows typical sections of such an inspection report.

So that the refinery board will be familiar with what the general maintenance conditions are at the refinery, copies of all such reports are submitted to it.

Refinery Prepares Yearly Budget

Working from these inspection reports and a general knowledge of what shape the refinery is in, around the middle of November the general maintenance foreman of each refinery prepares an estimated maintenance budget for the following year.

This estimate is divided into two sections. The first section includes the basic maintenance items, the repairs which it is known from previous experience will have to be made to keep units working satisfactorily. These include such items as renewing pump packings, replacing occasional lines and fittings, and replacing burned out tube hangers. In general, these are the jobs which cost less than



SECTION I - HEATERS 1.

A. Light Oil, RT 83-96

Part	Condition	Remarks
Brickwork	Fair	A few replacements were required. Burner blocks were coated with insulating cement.
Insulation	Fair	Expansion joints were packed. Material was replaced on closing-in plates of speaker section.
Steelwork	Good	Closing-in plates out of position were returned to place.
Breeching	Good	No repairs needed.

Heating elements	Material	Corrosion Penetration	Remarks
Preheater Tubes #1-#38	Carbon Steel	2/64" (6 mos.)	About 6 replacements needed within 6 months. Header boxes, satisfactory.
Tubes #34-#51	1¼% Chrome Alloy	Negligible	Header boxes, satisfactory.
Heater Tubes #52-#89	1¼% & 2% Chrome Alloy	5/64" (6 mos.)	Note #1.
Tubes #90-#117	1¼% Chrome Alloy	Negligible	Tubes and header boxes in excellent condition.
Speaker Tubes #118-#160	1¼% Chrome Alloy	None measurable	All in good condition. Tube exteriors oxidized and flaked-off extensively.
Crossovers	1¼% & 2% Chrome Alloy	Negligible	Satisfactory
Hydrostatic Test	1300 p.s.i.		Unusually satisfactory with respect to plug leaks.

Note #1 Tubes #56, #57, #64, #73, #80, #81 and #82, having reached a wall thickness of 1/4" or less after service periods varying from eighteen months to six and a half years, were retired and replaced by new tubes of 2% chrome alloy steel. An equal or greater number will require renewal within six months at the present corrosion rate of 1/8 i.p.y. maximum.

SECTION 7 - SUMMARY OF RECOMMENDATIONS 20.

A. New Recommendations

#1-1943
Install carbon steel liner in D-5 tower between Trays #3 and #11 during the Fall, 1943 inspection.

#2-1943
Retire D-9 Stripper from service, and reconnect piping to run light oil charge direct from D-2 tower to F-7 accumulator, during Fall, 1943 general inspection.

#3-1943
Renew outlet pipe from E-34 naphtha cooler tube bundle during Spring, 1944 inspection.

#4-1943
Retube E-5 crude preheater with plain carbon steel tubes during the Spring, 1944 inspection.

#5-1943
Repair deeply pitted channel for E-12 feedwater heater during earliest possible cleanout.

#6-1943
Renew G-11 suction line from F-3 accumulator to pump pipe during the Spring, 1944 inspection.

#7-1943
Renew discharge piping section 1944 inspection.

#8-1943

Fig. 2—Inspection reports such as these are kingpin of planned maintenance. While checking units, inspector looks not only for currently-needed maintenance but also estimates future requirements

Form 323 SM 2-24-43 P100 C-2153

THE PURE OIL COMPANY
ENGINEERING DEPARTMENT

SEE LETTER FILE NO. _____

PROJECT NO. L-11-44 JOB NO. 3215 ESTIMATE NO. 1 BY 1

LOCATION Toledo Refinery-- No. 3 CHP SHEET NO 1 of 1

TITLE Replace 220 tubes in upper portion of No. 3 CHP "R" Tower Vapor Line Cooler--RT8760 DATE 3-16-44

CODE	ITEM	MATERIAL	LABOR	TOTAL
	220 -- 1" O.D. x 14 gauge x 16'-0" long seamless Admiralty tubes	88000	20000	108000
	Miscellaneous	2500		2500
	Trucking	2500		2500
	Labor Benefits, Insurance @ 15% Labor		3000	3000
	TOTAL	93000	23000	116000

Refinery Work Order No.: 903-1935-3215

Fig. 3—Refinery board must approve all major maintenance jobs. Requests for this approval, such as the one above, include description of job, estimated material, labor costs, and refinery work order number

$500. They might be termed the "cat and dog" jobs. No attempt is made to list them separately; they're all lumped together for the unit to which they apply. No approval from the refinery board is required to handle this type of maintenance, and the individual refinery goes ahead with this work as needed.

Major maintenance projects make up the second section of the estimated budget. These are special jobs, above $500, normally requiring approval of the refinery board in Chicago before work can be started. Typical examples include: "retube visbreaker heating section," "replace three bubble trays in fractionating tower," "retube four condensers, complete," and "rebuild outside wall of No. 4 boiler." The estimate describes each job individually, as to the extent of the work to be done and the costs involved.

Maintenance Foreman Preplans Work

Many months prior to a regularly scheduled shutdown for any unit, the maintenance foreman at the plant begins making plans for the work to be taken care of then. He knows from the previous inspection reports and the maintenance budget estimate approximately the work to be handled.

First step in the case of the major jobs (those involving expenditures over $500) is to assign a "Refinery Work Order Number" to the job. This number is primarily for the accounting department, to assist in the proper distribution of costs. Such a refinery work order number might look something like this

903-1935-3215

The first three digits (903) are the general ledger code for refineries. The next group of digits (1935) is an accounting code and indicates two things. First, the "19" shows the unit upon which the work is to be done; each of Pure Oil's units throughout the country has its own identifying number. Second, the "35" defines the type of work to be done, in this case "repairs to condensers, coolers, heat exchangers." General or miscellaneous maintenance work would be identified as "30." The last group of numbers (3215) is merely an identifying number assigned consecutively by the refinery to differentiate one special job from another. This identifying number is necessary if it is desired to separate costs on various major jobs, for during the course of a year several similar maintenance jobs might be performed on the same unit, all carrying the same work number "1935."

Next step in these major jobs is to submit a request to the refinery board for approval to proceed with the work. A typical request of this nature is illustrated in Fig. 3. All of these requests are submitted in quintuplicate, and go directly to the chief clerk of the board in Chicago. He makes a record of each request received, primarily so that he can keep a finger on it and see that it doesn't get lost or overlooked in the shuffle, and then sends a copy to the chairman of the refinery board for approval.

The chairman, unless there is some question in his mind as to the necessity of doing the work outlined, approves the request without taking it before the entire board. He usually accepts the individual refinery's maintenance program without question. Submitting these requests, however, does give the board an opportunity to co-ordinate maintenance with other activities, and keeps it up to date on some of the problems besetting the man in the field. Also, there's always the possibility that by scanning all major maintenance work it can thus eliminate some which may be unnecessary, as in the case of the $7000 tower insulating job pointed out previously.

Next step at the Chicago office is to get the refinery work order number approved by the accounting department. Once these two approvals have been handled, the chief clerk returns the original request to the refinery, and distributes copies of it to the construction engineering and auditing departments.

Procedure and red tape, however, are not a part of Pure's program. The common purpose of everyone in the organization is to get the job done—to keep the equipment operating—to maintain the highest possible safety standards.

Unexpected major maintenance jobs may crop up at any time. Merely because they weren't anticipated and included in the yearly budget, or a formal request for approval sent to the refinery board, doesn't prevent them from being handled, however. If an urgent job comes up requiring immediate attention, the "go-ahead" signal can be obtained from the board in the length of time it takes to

send a wire to Chicago and back again.

The actual instructions to the maintenance men to perform the required work are all handled on "Work Orders." A typical work order is shown in Fig. 4. These usually originate from two sources.

The chief inspector, from his previous inspection and current observations, knows the special maintenance work he wants taken care of. For each of the various jobs he'll make out an order. Likewise, the foreman in charge of operating the unit from time to time notes things that require attention—valves that stick slightly, a minor leak at a joint, a loose bracket. He also makes out a work order for each of them. If they are urgent or can't wait until the next general shutdown, he'll ask to have them handled immediately. Otherwise the general maintenance foreman will accumulate them until the unit is down for periodic inspection and repairs.

So that the maintenance foreman can know exactly how much work any particular maintenance crew has ahead of it, the copy of each work order is filed according to the type of work involved—masonry, electrical, welding, pipe fitting. The original copy is then sent to the foreman of the maintenance crew that will do the work—and it is that foreman's responsibility to see that the work is taken care of.

All maintenance work and expenses can't be anticipated a year in advance. For this reason the yearly budget estimate isn't a rigid structure. How close actual expenses come to this budget, however, is some measure of how efficient the maintenance program is, and how close the inspection and maintenance departments keep their fingers on the plant's operations.

For this reason, the individual plants check their maintenance expenses regularly, drawing up charts such as those illustrated in Fig. 5, to show just how close they are "hitting the nail on the head."

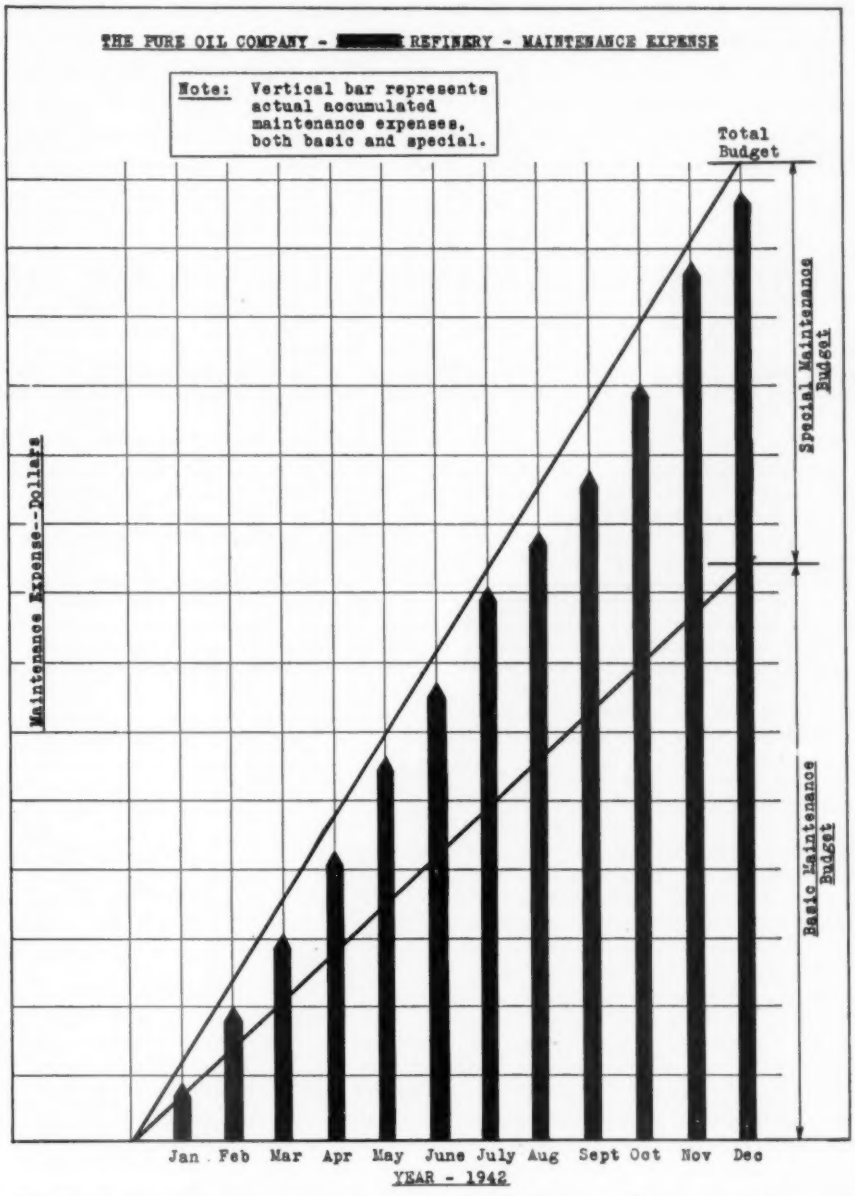

THE PURE OIL COMPANY - [redacted] REFINERY - MAINTENANCE EXPENSE
Note: Vertical bar represents actual accumulated maintenance expenses, both basic and special.
Total Budget
Special Maintenance Budget
Basic Maintenance Budget
Maintenance Expense--Dollars
Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec
YEAR - 1942

Fig. 5—Cost charts are prepared by individual refinery to show how their actual maintenance expenses compare with costs estimated in the budget

In the final analysis, however, it isn't the cost of the actual maintenance work which matters as much as it is the production lost because of shutdowns. This company believes the real test of any maintenance program is how well it works towards keeping the plant running at top efficiency a maximum number of days throughout the year.

Form 65C–1M Bks. 11-21-41 50 Sets to Bk.

THE PURE OIL COMPANY
WORK ORDER

178117

TO Mr. Burney

DATE: 2-29-1944

PLEASE 903-1935-3215

Replace 220 tubes in upper portion of #3 CHP "R" Tower Vapor Line Cooler.

DATE COMPLETED _____ TO BE COMPLETED Spring 1944 Insp

SIGNED _____ SIGNED W. F. Krahn /b

BPD. BY INT'L TAG & DATEBOOK CO., CHICAGO, ILL. WHEN COMPLETED, DATE AND RETURN TO PERSON ISSUING ORDER 21544A

Fig. 4—Work Order: actual instructions to maintenance workers to take care of jobs are written up on this simplified form, which requires approval only of general maintenance foreman

Catalytic cracking capacity totaling close to 900,000 B/D is being installed to enable the oil companies to supply the great volumes of aviation gasoline necessary for winning the war. In most cases this capacity is in addition to, rather than replacing, previously existing cracking plants. These catalytic cracking installations present major postwar economic problems for all refiners.

NPN's Technical Section presents two articles on this subject. The first is based on a study of the results of catalytic cracking on postwar supplies of motor gasolines, furnace oils and residual fuels. The second article (see p. R-342) discusses the effect of the production of light hydrocarbons (butanes and butylenes) on natural gasoline manufacturers' and refiners' operations.—Editor.

Effect of Catalytic Cracking on the Postwar Supply of Motor Gasolines and Fuel Oils

To supply the immense quantities of 100-octane aviation gasoline required by the military program and furnish stocks for the manufacture of synthetic rubber, the oil industry has installed catalytic cracking facilities on a large scale, in most cases in addition to existing thermal cracking units. Under ordinary conditions the installations would have been spread over a number of years, through replacing old equipment and as enlargements were required.

Because of these conditions as well as the peculiar features of catalytic cracking, there has been considerable speculation among refiners regarding the results it will have on the postwar supply of motor gasolines, household heating oil and Diesel and residual fuels. Reports are given from a study made to determine the direction of the changes and to evaluate their possible extent.

*By W. G. Moore** and T. G. Elder****

PRIOR to our entering the war, only one of the three catalytic cracking processes with which the industry is now familiar was in commercial operation and the installations of this one were confined very largely to the two companies who were instrumental in its development. In fact, if it had not been for the war, it seems likely that the adoption of catalytic cracking for the manufacture of motor fuel would have been rather gradual because it requires very marked economies to justify scrapping any process where the design is fairly modern and the equipment in good condition.

However, when it became evident that large quantities of aviation gasoline of 100-octane and above would be required, the economics with respect to motor fuel manufacture were disregarded. Catalytic units were installed on a large scale because, by a happy coincidence, they provided in quantity both a base gasoline for blending with high octane components and gases suitable for charging stocks to alkylation and other processes for the production of these components.

These gases also provided material for the production of synthetic rubber, giving further impetus to the building of this type of equipment. The charging capacity of these plants now installed, or under construction, is about 893,000 bbl. per calendar day, or 326,000,000 bbl. per year. This capacity represents 54% of the charge of all types of stocks to non-catalytic cracking units in 1940, which is the last year for which data are available. It should be noted that, except in a few instances, where catalytic cracking was installed it did not replace but was in addition to the existing cracking units.

Features of Catalytic Cracking

The peculiar features of catalytic cracking as compared to conventional cracking are, in general, as stated below. The proponents of the respective processes may quarrel somewhat with the figures used, but considering the wide variety of charge stocks involved, they are as nearly representative as we have been able to secure.

A. The cracked gasoline has an octane value (A.S.T.M.-Motor Method) of about 79 to 81 compared to 69 to 71 with non-catalytic cracking. Its susceptibility to lead, however, is about 5 to 6 numbers with 3 cc, as compared to about 9 for gasoline made by non-catalytic cracking.

The above statement is based on the assumption that natural catalyst would be used. Synthetic catalyst would give higher initial octane and better lead susceptibility but it is questionable whether the additional operating expense incurred would be offset by lead savings at the octane levels of the immediate postwar period.

B. In non-catalytic cracking, the residue is a tar which can only be put into residual fuel, while in catalytic cracking about 75% of the residue, or 37½% of the charge, can go into No. 2 furnace oil and the remainder, amounting to about 12½% of the charge, can be used as a cracking stock or put into residual fuel oil.

C. The production of dry gas, including the butanes in excess of the quantity that can be absorbed in motor fuel, is about 13.0% as compared to about 10.0% for non-catalytic cracking.

D. In the regeneration of the catalyst, the coke deposition provides a substantial part of the heat requirements for the unit.

Reasons for Evaluation

In view of the large amount of catalytic cracking capacity installed, it seemed desirable, in the public interest, that the effect on the postwar supply of gasoline, furnace oil and residual fuel should be evaluated, so that the industry might have some idea of possible problems involved in supplying the demand for these products and that those who use the products might know how the supply is likely to be affected. The study is limited to this purpose and is not valid for drawing conclusions of either an economic or operating nature.

Method of Evaluation

General

The additional cracking capacity installed, plus the peculiar features of catalytic cracking, give a refiner a wider range in the quantity of gasoline and distillate fuels he can make from the same quantity of crude, with, however, a corresponding reduction in the residual fuel made. The ways in which the numerous individual refiners will elect to operate their equipment cannot, of course, be predicted, because it will be determined by the demand and price

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°This paper was originally presented before the Petroleum Section, American Institute of Mining and Metallurgical Engineers, New York, Feb. 24, 1944, under the title, "A Study of the Effect of Catalytic Cracking on the Postwar Supply of Motor Gasoline and Distillate and Residual Fuels". Additional data on West Coast and Rocky Mountain operations were later supplied by the authors and are included in this presentation.

°°Assistant to the President, Gulf Oil Corp., Pittsburgh.

°°°Refinery Executive, Arthur G. McKee & Co., Cleveland, formerly Superintendent of Refineries, National Refining Co.

level for the various products, and the availability and price of crude. The most useful information that can be presented, then, is data showing the flexibility of operation and the resultant change in product make.

The method employed is to use as a basis of comparison the latest year when the use of catalytic cracking was negligible, which was 1940, and to show what the industry-wide effect would have been if there had been the catalytic cracking capacity that is now built, or being installed, plus the non-catalytic cracking capacity that was used in 1940, when operating under each of the three following alternatives:

A. Running the same amount of crude and making the same amount of distillate fuel as in 1940 and then making maximum gasoline.

B. Running the same amount of crude and making the same amount of gasoline as in 1940 and then making maximum distillate fuel.

C. Running only enough crude to make the same amount of gasoline and the same amount of distillate fuel as made in 1940.

Regional Effect

Catalytic cracking capacity is quite unevenly distributed throughout the country. The circles on the accompanying map in Fig. 1 (see p. R-338) indicate the location and relative amount of the capacity installed in the refining centers. Because an evaluation made on a national basis would be quite misleading for particular regions, we have divided the country into the areas outlined on the map, which may be roughly indicated as "East and Gulf Coasts", "Mid-Continent", "Rocky Mountains" and "West Coast".

The extent of each individual area was determined by the distribution of products from the refineries within the area, so that any change in the volume of products made would have an equal effect on the supply available. This requirement made the areas quite large, because the products move long distances from the points of manufacture, due to their transportation by tankers and product pipelines and because of certain Mid-Continent rate structures.

The uneven distribution of catalytic cracking is shown in the following Table 1 comparing the distribution of the total 1940 U. S. crude charge with the installed catalytic capacity, by areas.

Availability of Charging Stocks

Under the urgency of the aviation program, catalytic cracking was installed without much regard to whether there would be sufficient suitable stocks to charge to such units when running for motor fuel, with the normal crude charge. In some cases, catalytic capacity was installed in excess of crude charging capacity, because it was planned to use some of the equipment for treating aviation blending stocks. For example, catalytic refiners in the East and Gulf Coasts area increased their cracking capacity by 111%, which gives them total cracking capacity equivalent to 72% of their 1940 crude charge. For the Mid-Continent area, the corresponding figures are 207% increase in cracking capacity, with total cracking equivalent to 105% of their 1940 crude charge.

An estimate of charging stock available in relation to cracking capacity, when based on a grouping of refineries, contains considerable room for error because surpluses at some refineries are combined with shortages at others to make an average that is in excess of the quantity actually available, since in practice there is no way of washing out a shortage at one refinery with a surplus at another except in isolated instances.

To determine the amount of stock suitable for charging to catalytic units and to avoid the error inherent in dealing with refineries as a group, it was necessary to determine the availability of stocks at each individual refinery having catalytic equipment.

Refineries Without Catalytic Equipment

179,000,000 bbl. of crude, or 28% of the total run in the East and Gulf Coasts area in 1940, was processed by refineries without catalytic equipment. In the other areas the corresponding figures were: Mid-Continent, 275,000,000 bbl. or 76%; Rocky Mountains, 23,700,000 bbl. or 80%; West Coast 31,000,000 bbl. or 15%. Since the operation of these refineries would not be affected by catalytic cracking, it was desirable to segregate their production.

Source of Basic Data

We are indebted to the PAW for furnishing the location and rated charging capacity of catalytic units, as of June 1943.

The data which would enable us to make evaluations by regions; determine the amount of stock suitable for charging to catalytic units at each refinery having such equipment; and segregate the production of refineries without catalytic equipment, were available from the reports covering refinery input and output made monthly to the Bureau of Mines by all refineries. The companies with catalytic equipment were kind enough to authorize the Bureau of Mines to make their 1940 reports available to us and by subtracting the figures for the catalytic refineries from the state totals for all refineries, we were able to segregate the combined production of refineries without catalytic equipment, for any grouping of states desired. We wish to express our appreciation to both the companies and the Bureau of Mines for furnishing data which contributed materially to the accuracy of the evaluations. We are also indebted to R. L. Minckler of the General Petroleum Corp. for his assistance in securing data covering the Pacific Coast.

TABLE 1

(Distribution of 1940 U. S. Crude Charge Compared with Installed Catalytic Cracking Capacity, by Areas)

Area	Percentage of Total U. S. 1940 Crude Charge	Percentage of Total U. S. Catalytic Capacity Installed
East and Gulf Coasts	49.6%	59.7%
Mid-Continent	27.8%	19:8%
Rocky Mountain	2.3%	1.9%
West Coast	15.5%	18.6%
Inland Texas	4.8%	0.0%
Total United States	100.0%	100.0%

Evaluation

For each refinery under consideration, the Bureau of Mines data on input and output for the year 1940 showed the amount of crude, unfinished gasoline, natural gasoline, etc. charged, and gave the volume of each product made, together with the amount produced by cracking operations. The yields were adjusted to give the net production from the crude itself and all figures presented in this report refer to crude operations only. The sum of the cracked products enabled us to determine the total charge to cracking equipment for each refinery. From this was deducted the estimated amount of cracked gasoline, residual fuel and gas made by naphtha reforming and vis-breaking, to arrive at the distillate charge available for catalytic operations, and the volumes of products resulting from the non-catalytic cracking of this stock, for comparison with catalytic operations.

In loading the equipment, preference was given to the catalytic units and where there was insufficient pressure still stock, straight-run furnace oil was charged where available.

In this evaluation, the catalytic equipment was operated on a once-thru basis, the non-catalytic equipment operated recycle, to correspond with the method of determining the available capacity for each type of operation.

Coke deposition on the catalyst was treated as refinery fuel and was converted to equivalent liquid volume and included in the production of residual fuel oil.

To simplify this study, we have assumed that the entire volume of gasoline shown in the tabulations is of motor grade and have taken no account of the additional volume which will undoubtedly be produced as high-octane blending components from processing of the excess gas. We have assumed this latter volume will correspond to the aviation gasoline requirements.

The yields used are set forth in Table 2. Two of the three processes have been operated almost exclusively for aviation gasoline and, consequently, data when running for motor fuel are very limited, but we believe the figures used are reasonably representative.

This tabulation may prove difficult to read if the headings are not studied

carefully. The first section headed "Catalytic Cracking" shows the yields, reading down, which result from the catalytic cracking of virgin pressure still stock and from virgin furnace oil. The right hand section headed "Non-Catalytic Cracking", reading across the tabulation, shows the yields from conventional cracking of the virgin pressure still stock, virgin furnace oil, and the catalytic furnace oil and pressure still stocks resulting from the catalytic cracking of the virgin stocks.

For those refiners having catalytic units, in all three of the alternates set up, there is substantial idle capacity in both their catalytic and non-catalytic equipment when running their 1940 crude. The percentages are as given in Table 3.

For the East and Gulf Coasts area, the capacity of the non-catalytic equipment used in 1940 has been reduced by the known conversions to catalytic cracking. This is estimated at about 8,000,000 bbl. per year. We have no knowledge of conversions in the other areas. However, there probably has been some equipment abandoned in all areas because of obsolescence and undoubtedly more will be scrapped after the war, for the same reason. No attempt has been made to estimate the extent of this.

There are of course, several ways in which this idle equipment might be loaded, such as:

1. Recycling on the catalytic equipment, which would make still more non-catalytic capacity idle, and

2. Extracting heavy stocks from the reduced crude now sold as fuel or visbroken.

However, since there is little reliable economic data on the relative merits of catalytic recycling versus utilization of idle non-catalytic capacity, and since it is questionable whether the required equipment for preparation of the heavier stocks will be available in the first two postwar years, no consideration has been given to these possibilities.

Tabulation of Results

The evaluations covering each of the four areas are summarized in Table 4.

The quantities shown are from crude operations only, the blending of natural gasoline and processing of unfinished stocks having been eliminated from both the input and output.

It should be noted that the results shown under the caption "1940 Actual", sub-caption "Refiners with Catalytic Units now built or building", were obtained with non-catalytic cracking, as the amount of catalytic equipment operating in that year was negligible. The production of this group of refiners in 1940 is segregated only for comparison with the results given for the same group when operating under the alternatives shown.

The columns headed "All Refiners" show the results after dilution by those refiners not now installing catalytic equipment.

The figures given in the tabulation must not be taken as a prediction of absolute results, but rather as indicating the direction and the possible extent of changes, since each of the three alternative operations evaluated is predicated on every refiner operating in the assumed manner, whereas, in fact, individual refiners will operate in different ways, depending upon many considerations peculiar to their particular situations. Also, some companies have installed catalytic cracking capacity equal to or greater than the charge to their non-catalytic units in 1940, while others have installed a much smaller percentage. Consequently, the effect of catalytic cracking in the case of individual companies will vary considerably from the group averages shown.

Comments

The figures given in the tabulation are too voluminous to comment on in detail, but the following general observations may be made.

The most important effect of the catalytic equipment installed is to greatly increase the flexibility of operation thru increased cracking capacity and the peculiar features of catalytic cracking.

There will be a substantial increase in the amount of light products obtained from a barrel of crude, which may be taken either as gasoline or distillate fuel, and a substantial reduction in the amount of residual fuel oil made.

While the amount of residual fuel oil per barrel of crude will be less, the quantity of crude run will also determine the total supply. The figures given in this study relate only to the crude run in 1940, which was 3,555,000 bbl. Two other factors that would tend to reduce the fuel supply are (a) utilizing the heavier portions of the crude for charging to catalytic units and (b) further installations of catalytic units.

Gasolines of higher octane number will be made and the proportion of cracked to straight run will increase.

The quantity of distillate fuel that can be made will be substantially greater, but there will be a material increase in the percentage of cracked furnace oil in fuels for household heating. This increase in the percentage of cracked material is favorable from the standpoint of the economical use of our petroleum resources, but should receive attention from equipment manufacturers to insure that burners are properly adapted to its use.

There will be a reduction in the crude required for making a given demand of gasoline and distillate fuels, at the expense of residual fuel.

There will be an increase in the production of gas, but the butenes above

TABLE 2—Yields from Catalytic and Non-Catalytic Cracking

CATALYTIC CRACKING (Read down for yields) Charge & Product	Yield	NON-CATALYTIC CRACKING (Read across for yields from conventional cracking of virgin stocks & residues from catalytic cracking) Gasoline	Fuel Oil	Gas (FOE)	Gain
Charge: Virgin P S Stock		55.0%	36.0%	10.0%	1.0%
Products:					
Gasoline	40.0%				
Catalytic Furnace Oil	37.5%	50.0%	40.0%	10.0%	0.0%
Catalytic Bottoms (P.S.S.)	12.5%	30.0%	64.5%	6.0%	0.5%
Total Catalytic Residue	50.0%	45.0%	46.1%	9.0%	0.1%
Gas—F.O.E.*	13.0%				
Coke—F.O.E.	2.0%				
Gain	5.0%				
Charge: Virgin Furnace Oil		65.0%	23.5%	12.0%	0.5%
Products:					
Gasoline	40.0%				
Catalytic Furnace Oil	40.0%	60.0%	27.5%	12.0%	—0.5%
Catalytic Bottoms	7.5%	30.0%	64.5%	6.0%	0.5%
Total Catalytic Residue	47.5%	55.3%	33.3%	11.0%	—0.4%
Gas—F. O. E.	13.0%				
Coke—F.O.E.	2.0%				
Gain	2.5%				

*Fuel Oil Equivalent.

TABLE 3—Percentages of Idle Cracking Capacity in Catalytic and Non-Catalytic Equipment (1940 Operations)

Operation	EAST & GULF COASTS Catalytic Capacity % Idle	EAST & GULF COASTS Non-Cat. Capacity Used in 1940 % Idle	MID-CONTINENT Catalytic Capacity % Idle	MID-CONTINENT Non-Cat. Capacity Used in 1940 % Idle	ROCKY MOUNTAINS Catalytic Capacity % Idle	ROCKY MOUNTAINS Non-Cat. Capacity Used in 1940 % Idle	PACIFIC COAST Catalytic Capacity % Idle	PACIFIC COAST Non-Cat. Capacity Used in 1940 % Idle
A	29.0	48.0	62.0	44.0	70.9	30.8	40.0	52.0
B	35.0	57.0	63.0	51.0	73.8	41.3	53.0	57.0
C	33.0	54.0	63.0	47.0	73.8	33.0	50.0	55.0

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Pumping 250,000 gallons of water a minute . . . 360,000,000 gallons a day . . . these two 800 hp Type G-MV gas engines supply all the water used in the vast $45,000,000 rubber project at Port Neches.

Engine speed and pumping performance are accurately regulated by special Cooper-Bessemer automatic controls, so that exactly the desired water volume and pressure are maintained constantly. It is significant of the confidence placed in Cooper-Bessemer G-MV's that they must run continuously, day and night, without standby equipment.

Dependability and freedom from operating troubles are well-known Cooper-Bessemer qualities—proved by millions of horsepower working steadily for years in the oil fields, in refineries, natural gasoline plants, gas transmission stations and processing plants. No wonder men turn to Cooper-Bessemer whenever they need utmost reliability in an engine or compressor.

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Distribution of Catalytic Cracking Capacity

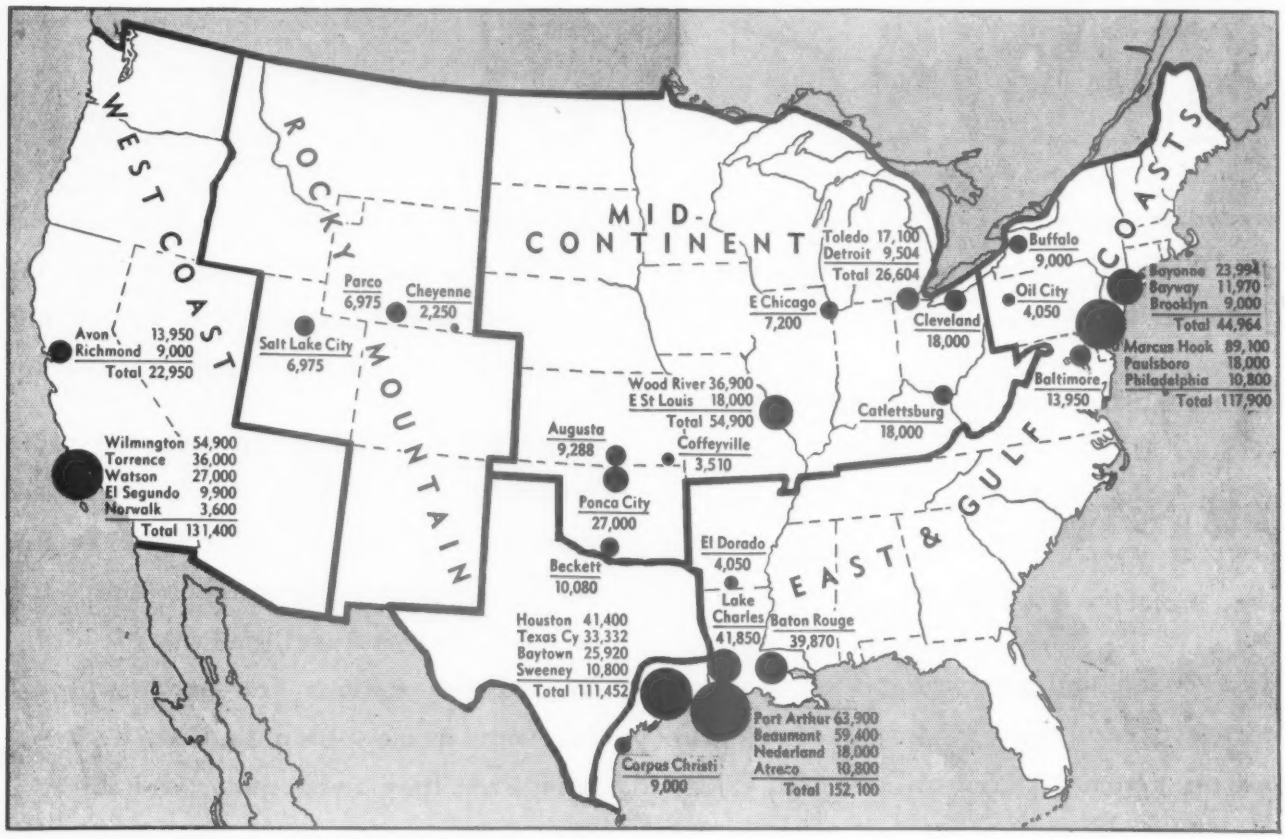

Fig. 1—Location of catalytic cracking capacity by refining centers and regional areas, as of June, 1943. Figures are in barrels per calendar day for plants built or building

TABLE 4—Comparison of 1940 Actual Refinery Production with Estimated Product Make from the Same Crude, Under Various Operating Conditions, Using the 1940 Non-Catalytic Cracking Plus Catalytic Equipment Installed or Authorized as of June, 1943

Item		1940 Actual Operations		(A) Maximum Gasoline Production after Making 1940 Volume of Furnace Oils		(B) Maximum Furnace Oil Production after Making 1940 Volume of Gasoline		(C) Crude Required for Making 1940 Volumes of Furnace Oils & Gasoline	
		With Negligible Catalytic Cracking		With Catalytic Cracking to the Extent of Suitable Stocks Available from 1940 Crude Runs					
		Refiners with Catalytic Units now Built or Building	All Refiners	Refiners with Catalytic Units now Built or Building	All Refiners	Refiners with Catalytic Units now Built or Building	All Refiners	Refiners with Catalytic Units now Built or Building	All Refiners
East & Gulf Coast Area									
YIELDS									
Gasoline	MB/Y	188,329	251,834	201,855	265,360	Same as 1940	Same as 1940	Same as 1940	Same as 1940
% Change over 1940				7.2	5.4				
Furnace Oil	MB/Y	77,046	112,171	Same as 1940	Same as 1940	94,982	130,107	Same as 1940	Same as 1940
% Change over 1940						23.3	16.0		
Residual Fuel Oil	MB/Y	106,899	148,835	89,980	131,916	86,336	128,272	83,145	125,081
% Change over 1940				—15.8	—11.4	—19.2	—13.8	—22.2	—16.0
Fuel Gas	MB/Y	24,450	30,616	29,634	35,800	26,977	33,143	27,556	33,722
% Change over 1940				21.2	16.9	10.3	8.3	12.7	10.1
CRUDE REQUIRED	MB/Y	463,240	641,956	Same as 1940	Same as 1940	Same as 1940	Same as 1940	436,986	615,702
% Change over 1940								—5.7	—4.1
PRODUCT BLEND									
Gasoline									
% Straight Run		39.6	43.3	36.9	41.1	39.2	43.0	37.4	41.7
% Non-Catalytically Cracked		60.4	56.7	37.6	39.5	35.8	38.2	36.9	39.1
% Catalytically Cracked		—	—	25.5	19.4	25.0	18.8	25.7	19.2
% Total Cracked		60.4	56.7	63.1	58.9	60.8	57.0	62.6	58.3
Furnace Oil									
% Virgin		63.7	69.0	30.0	45.8	41.2	51.8	33.7	48.3
% Non-Catalytically Cracked		36.3	31.0	13.4	15.3	12.5	14.4	13.2	15.2
% Catalytically Cracked		—	—	56.6	38.9	46.3	33.8	53.1	36.5
% Total Cracked		36.3	31.0	70.0	54.2	58.8	48.2	66.3	51.7

Continued on opposite page

TABLE 4 (Continued)

Item		1940 Actual Operations		(A) Maximum Gasoline Production after Making 1940 Volume of Furnace Oils		(B) Maximum Furnace Oil Production after Making 1940 Volume of Gasoline		(C) Crude Required for Making 1940 Volumes of Furnace Oils & Gasoline	
		With Negligible Catalytic Cracking		With Catalytic Cracking to the Extent of Suitable Stocks Available from 1940 Crude Runs					
		Refiners with Catalytic Units now Built or Building	All Refiners	Refiners with Catalytic Units now Built or Building	All Refiners	Refiners with Catalytic Units now Built or Building	All Refiners	Refiners with Catalytic Units now Built or Building	All Refiners
Mid-Continent Area									
YIELDS									
Gasoline	MB/Y	45,579	189,114	46,754	190,289	Same as 1940	Same as 1940	Same as 1940	Same as 1940
% Change over 1940				2.6	.6				
Furnace Oil	MB/Y	9,638	36,509	Same as 1940	Same as 1940	11,671	38,542	Same as 1940	Same as 1940
% Change over 1940						21.1	5.6		
Residual Fuel Oil	MB/Y	12,041	63,992	10,475	62,426	9,764	61,715	9,954	61,905
% Change over 1940				—13.0	—2.4	—18.9	—3.6	—17.3	—3.3
Fuel Gas	MB/Y	6,366	21,911	6,413	21,958	6,182	21,727	6,363	21,908
% Change over 1940				.7	.2	—2.9	—.8	—	—
CRUDE REQUIRED	MB/Y	84,876	359,924	Same as 1940	Same as 1940	Same as 1940	Same as 1940	82,966	358,014
% Change over 1940								—2.3	—.5
PRODUCT BLEND									
Gasoline									
% Straight Run		39.3	47.2	38.3	46.9	39.2	47.2	38.4	47.0
% Non-Catalytically Cracked		60.7	52.8	42.4	48.4	41.4	48.1	42.4	48.4
% Catalytically Cracked		—	—	19.3	4.7	19.4	4.7	19.2	4.6
% Total Cracked		60.7	52.8	61.7	53.1	60.8	52.8	61.6	53.0
Furnace Oil									
% Virgin		73.0	72.8	28.3	61.0	26.1	58.6	28.5	61.0
% Non-Catalytically Cracked		27.0	27.2	12.1	23.3	10.0	22.1	9.9	22.7
% Catalytically Cracked		—	—	59.6	15.7	63.9	19.3	61.6	16.3
% Total Cracked		27.0	27.2	71.7	39.0	73.9	41.4	71.5	39.0
Rocky Mountain Area									
YIELDS									
Gasoline	MB/Y	3,608	15,341	3,828	15,561	Same as 1940	Same as 1940	Same as 1940	Same as 1940
% Change over 1940				6.1	1.4				
Furnace Oil	MB/Y	414	2,074	Same as 1940	Same as 1940	683	2,343	Same as 1940	Same as 1940
% Change over 1940						65.0	13.0		
Residual Fuel Oil	MB/Y	916	6,554	875	6,513	866	6,504	805	6,443
% Change over 1940				—4.5	—0.6	—5.5	—0.8	—12.1	—1.7
Fuel Gas	MB/Y	456	1,432	510	1,486	462	1,438	478	1,454
% Change over 1940				11.8	3.8	1.3	0.4	4.8	1.5
CRUDE REQUIRED	MB/Y	5,939	29,666	Same as 1940	Same as 1940	Same as 1940	Same as 1940	5,609	29,336
% Change over 1940								—5.6	—1.1
PRODUCT BLEND									
Gasoline									
% Straight Run		49.0	56.3	46.2	55.6	49.0	56.3	46.3	55.7
% Non-Catalytically Cracked		51.0	43.7	35.4	39.9	33.8	39.6	36.2	40.2
% Catalytically Cracked		—	—	18.4	4.5	17.2	4.1	17.5	4.1
% Total Cracked		51.0	43.7	53.8	44.4	51.0	43.7	53.7	44.3
Furnace Oil									
% Virgin		92.0	88.3	29.2	75.7	23.6	68.8	29.2	75.7
% Non-Catalytically Cracked		8.0	11.7	5.8	11.3	3.5	10.0	5.8	11.3
% Catalytically Cracked		—	—	65.0	13.0	72.9	21.2	65.0	13.0
% Total Cracked		8.0	11.7	70.8	24.3	76.4	31.2	70.8	24.3
West Coast Area									
YIELDS									
Gasoline	MB/Y	57,314	67,499	63,259	73,444	Same as 1940	Same as 1940	Same as 1940	Same as 1940
% Change over 1940				10.4	8.8				
Furnace Oil	MB/Y	28,979	31,596	Same as 1940	Same as 1940	35,501	38,118	Same as 1940	Same as 1940
% Change over 1940						22.5	20.6		
Residual Fuel Oil	MB/Y	64,507	79,124	57,734	72,351	57,491	72,108	54,717	69,334
% Change over 1940				—10.5	—8.6	—10.9	—8.9	—15.2	—12.4
Fuel Gas	MB/Y	6,682	7,227	9,651	10,196	8,300	8,845	8,550	9,095
% Change over 1940				44.4	41.1	24.2	22.4	28.0	25.8
CRUDE REQUIRED	MB/Y	170,024	201,023	Same as 1940	Same as 1940	Same as 1940	Same as 1940	158,810	189,809
% Change over 1940								—6.6	—5.6
PRODUCT BLEND									
Gasoline									
% Straight Run		49.4	53.3	44.8	49.0	48.9	52.8	46.3	50.7
% Non-Catalytically Cracked		50.6	46.7	33.8	32.6	32.6	31.5	33.9	32.5
% Catalytically Cracked		—	—	21.4	18.4	18.5	15.7	19.8	16.8
% Total Cracked		50.6	46.7	55.2	51.0	51.1	47.2	53.7	49.3
Furnace Oil									
% Virgin		80.7	82.3	57.0	60.6	64.6	67.0	67.3	70.0
% Non-Catalytically Cracked		19.3	17.7	3.6	3.3	7.6	7.0	5.3	4.9
% Catalytically Cracked		—	—	39.4	36.1	27.8	26.0	27.4	25.1
% Total Cracked		19.3	17.7	43.0	39.4	35.4	33.0	32.7	30.0

Note—All figures represent net production from crude operations only, eliminating casinghead gasoline blended and charge from unfinished products, etc.

Note—Figures with minus signs represent decreases.

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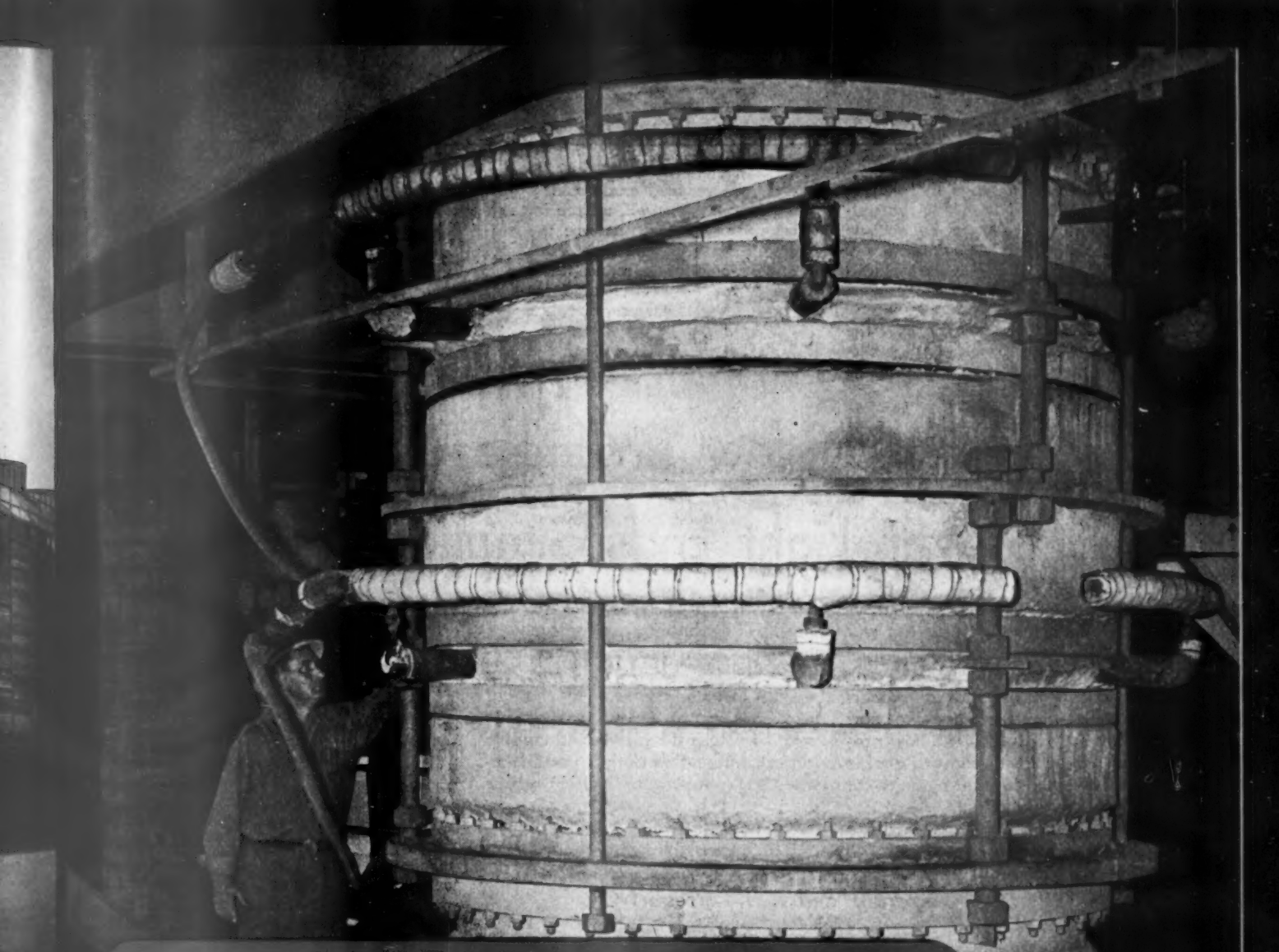

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vapor pressure requirements and possibly the propenes, will undoubtedly be utilized for the production of high-octane blending components for aviation and motor gasolines. The results of such operations are not reflected in the tabulations.

With increased cracking capacity, the tendency will probably be to use otherwise idle capacity for cracking stocks now in the reduced crude sold as fuel or vis-broken. This will reduce the volume of residual fuel, increase the production of gasoline and furnace oil from the same crude and reduce the crude required for a given volume of light products, over the figures shown in the tabulations.

With regard to the relative effects in the several areas, it will be noted that while the direction is the same, the magnitude varies. For example, the effect is much greater in the East and Gulf Coasts than in the Mid-Continent. This is due to two reasons; less catalytic cracking was installed in the Mid-Continent and refiners in this area made a greater percentage of gasoline, with less distillate and residual fuel, from their 1940 crude runs.

How Will the New Processes Affect The Postwar Light Ends Situation?*

While the extensive catalytic cracking facilities installed during the war will produce larger amounts of light fractions than heretofore, there will be increased uses for these hydrocarbons. It is indicated that the new consumption will exceed the new production, but not sufficiently to enable utilizing all recoverable butanes for purposes other than fuel.

Butanes from natural gasoline sources will apparently have as large a field of use as before the war but there will probably be large amounts that cannot be utilized except as refinery fuel.

Little likelihood is seen of changes in average front end motor gasoline volatility which if made would call for larger consumption of light ends. Likewise, the relaxing of present vapor pressure limits of motor gasoline to make possible the utilization of surplus butanes is not considered feasible.

*By D. P. Barnard** and J. H. Forrester***

BUTYLENE and isobutane today probably have the distinction of being the most diligently pursued hydrocarbons in the history of the petroleum industry, with isopentane possibly sharing the honors. Butylene and isobutane are the backbone of 100-octane aviation gasoline and the largest single part of our synthetic rubber program starts with butylene. The supply of isopentane for blending into aviation gasoline has never been more than one jump ahead of requirements, and usually a few jumps behind.

Tremendous investment has been made in catalytic cracking equipment primarily because the process can be operated to produce large amounts of butylene and isobutane; many installations have been made for isomerizing normal butane and a few for isomerizing normal pentane. Refiners without facilities in which to utilize the butylenes produced by their thermal cracking processes for war products have been called upon to ship their B-B fractions to other refiners who do have such facilities, or to recover the butylenes by polymerization to codimer for hydrogenation. Natural gasoline operators have been called upon to wring isobutane and isopentane from their distillation equipment in any possible manner.

Although there is new production of these three critical light hydrocarbons, from the catalytic cracking units and from abnormal operation of thermal cracking units, a very large part has been obtained by direct withdrawal from motor gasoline either by the refiner or by the natural gasoline operator whose product is blended into motor gasoline. The result is, first, that today's motor gasoline is depleted in volatility, and second, there is a ready market for any butane or pentane that can be released for motor gasoline blending.

Current dealings in these light hydrocarbons are so large, with on the one hand the enormous newly constructed consuming capacity and on the other hand the enormous newly constructed producing capacity, that it is in order to consider what balance may be reached in the postwar situation. An attempt is made to analyze each of the factors introduced by the war program so that the effect on the postwar light ends situation may be bracketed and to comment on problems that may arise in utilizing light ends.

Prewar Motor Gasoline

Just before the war there were produced approximately 1,700,000 b/d of motor gasoline that probably averaged approximately 66 octane number, motor method unleaded, 10 lb Reid vapor pressure and 22% evaporated at 158°F., although it would be extremely difficult to establish the latter two figures with much accuracy. Reid vapor pressure ranged between about 8 lb for summer grades to 12 lb for winter grades while production at refineries, without butane discard to refinery fuel, polymerization or natural gasoline importation, probably averaged slightly more than 10 lb RVP. The butane fraction was a marginal component of motor gasoline; it was incorporated to the extent permitted by vapor pressure specifications, or availability, and the excess disposed of by polymerization of butylenes or discard to fuel. A relatively unimportant amount was consumed in the manufacture of alkylate, hydrocodimer, synthetics and chemicals.

The total butane production in the prewar year of 1940 has been estimated to be between 250,000 b/d and 350,000 b/d. Nelson[1] estimated the butanes production and disposition during this year as follows:

	Sold in Products Bbls./day	Lost, burned discarded, etc. Bbls/day
Produced in		
Natural gasoline plants	45,000	49,000
Petroleum refineries	105,000	26,700
Total sold in motor fuels	150,000*	
Liquefied petroleum gases	11,300	
In unprocessed lean field gases	.....	16,000
		(to 106,000)
Total	161,300	91,700
		(to 181,700)

*Includes butylenes used by polymerization.

Nelson indicates that of the amount lost, burned and discarded approximately 64,000 b/d are potentially recoverable. This would include the entire 49,000 b/d from natural gasoline plants, 5,000 b/d from unprocessed lean gases, or a total of 54,000 b/d from natural sources, and 10,000 b/d of the 26,700 b/d discarded at refineries.

Total natural gasoline production in 1940 was 153,000 b/d which included the above 45,000 b/d of butane, the remainder being pentanes and heavier. The pentanes and heavier components in

*Presented before the Natural Gasoline Assn. of America, Tulsa, April 13, 1944.

**Research Department, Standard Oil Co. (Indiana), Whiting, Ind.

[1] Oil and Gas Journal, January 22, 1942.

natural gasoline could generally find a ready market for motor gasoline blending since these components did not impose a significant vapor pressure problem, were reasonably susceptible to storage, and were desirable for increasing front end volatility of motor gasoline. Since butanes are not easily stored, a significant portion of the excess produced during the summer was discarded to fuel gas or polymerized to motor polymer.

Thus, the prewar motor gasoline of approximately 1,700,000 b/d contained approximately 45,000 b/d of butane and 108,000 b/d of pentanes and heavier from natural gasoline. Approximately 50,000 b/d of recoverable butane from natural sources were rejected to fuel gas because there was no other demand, and approximately 11,000 b/d were sold as liquefied petroleum gases. The seasonal variation in motor gasoline specifications caused the demand for butane to be greater in the winter than in the summer.

Effect of War Built Processes

The equipment constructed as a part of the war program has included two items with potentially significant, and opposing, effects on the national light ends situation; first, a large amount of catalytic cracking capacity that tends to increase the production of light hydrocarbons, and second, butane and butylene consuming capacity for making aviation alkylate and butadiene for rubber. The other principal refining processes included in the war program, hydroforming and isomerization, may be disregarded since neither has significant effect on the production of light hydrocarbons. Some butylene consuming capacity has been installed for the production of synthetics and chemicals.

Table 1 presents a summary of the estimated effect of the new processes on the postwar light ends situation. The upper portion of the table indicates the effect of the new catalytic cracking capacity on butane production, while the lower portion indicates the probable order of magnitude of the new butane and butylene withdrawals. The effects of the new processes have been superimposed on a postulated postwar motor gasoline production of 2,000,000 b/d which, without the new processes, would have averaged 10 lb RVP, 22% evaporated at 158°F. and 66-octane number, motor method unleaded. This gasoline, when made by the prewar processes, would have included about the prewar amount of butane from natural sources, the excess natural butane being consumed as fuel.

Table 1 shows that the estimated net effect of catalytic cracking will be to increase the front end volatility of average motor gasoline by less than 1% at 158°F., the octane number by approximately 2.6 units, and to produce approximately 37,000 b/d more butanes than can be incorporated in the same amount of total gasoline of the same vapor pressure. The total new butane-butylene withdrawals, however, are estimated to be 57,000 b/d, thus indicating that other things being equal, the war built equipment will have the overall effect of permitting 20,000 b/d of butane to be withdrawn from the amount formerly going to fuel at the natural gasoline plants or refineries. The effect on front end volatility of motor gasoline is negligible. It appears, therefore, that the war built processes will create a small new demand for butane but this demand will probably be less than the 50,000 to 60,000 b/d of recoverable butane being discarded to fuel. The estimates forming the basis of the butane balance are, however, in some instances subject to considerable range. Also there are influences other than the war built equipment. These factors are explored in the following paragraphs.

Catalytic Cracking

The catalytic cracking units in the war program, when operated for the manufacture of motor gasoline, will be capable of charging approximately 1,000,000 b/d of gas oil and producing approximately 435,000 b/d of 10 lb RVP naphtha which will be accompanied by approximately 65,000 b/d of butanes in excess of the amount that can be incorporated in 10 lb RVP finished gasoline. It is here assumed that an equal amount of thermally cracked gasoline would be displaced with an attendant excess butane production of 28,000 b/d, leaving 37,000 b/d net excess butane as the result of catalytic cracking. This amount represents the best estimate, but the net excess butane may be as high as 60,000 b/d or as low as 20,000 b/d.

There is room for much speculation about the catalytic cracking capacity that will be operated in the postwar period. Since the gas oil consuming capacity of a catalytic unit is less when making war products than when making motor gasoline, the catalytic cracking capacity in some refineries will exceed the gas oil available within that refinery. Moore and Elder[2] estimate that such instances may amount to 29% of the total catalytic cracking capacity on the gulf and east coasts, where over one-half of the catalytic cracking capacity is concentrated. This increment of capacity may be unused, or it may be used by importation of gas oil, recycling catalytic gas oil, or by expanding crude run. Any amount unused may be more than offset by construction of new catalytic cracking units at refineries not having such units as soon as materials are obtainable. It is significant to note that a crude run of over 4,000,000 b/d could sustain 2,000,000 b/d of catalytic cracking. It is, therefore, potentially possible that the present capacity may be doubled, and it seems conservative to assume that there will be 1,000,000 b/d of gas oil catalytically cracked in the early postwar period.

The assumption that catalytic gasoline will displace thermally cracked gasoline is subject to minor inaccuracies if advantage is generally taken of the fact that by catalytic cracking plus thermal cracking of the catalytic cycle stock it is possible to obtain a higher yield of gasoline on crude than by thermal cracking alone. Typical yields for the two crack-

[2] Presented before the Petroleum Section of the AIMME, New York, Feb. 24, 1944.

TABLE 1—Effect of New Process on Post-war Light End Situation

	Motor Fuel Production Bbls./Day	Properties RVP Lbs./Sq. In.	Properties Per Cent Evap. at 158°F.	Properties Octane No. Motor Method Unleaded	Excess Butane Above 10 Lb. RVP Gasoline Per Cent on 10 Lb. RVP Gasoline	Excess Butane Above 10 Lb. RVP Gasoline Bbls./Day
Total Motor Fuel Production With Approximately Average Pre-War Properties	**2,000,000**	**10.0**	**22.0**	**66**	**Base Situation**	
Effect of War Built Catalytic Cracking Equipment						
(a) Catalytically Cracked Gasoline from War Built Facilities	+435,000	10.0	25.0	80	15.0	+65,000
(b) Withdraw Thermally Cracked Gasoline Displaced	—435,000	10.0	23.0	68	6.5	—28,000
Net Effect of Catalytic Cracking	2,000,000	10.0	22.4	68.6	1.8	+37,000
Estimated New Butane and Butylene Withdrawals (Above Pre-War Period) in Early Post-War Period						
(a) Butylene for 25,000 B/D Aviation Alkylate						—33,000
(b) Butane and Butylene to Make 250,000 tons/Yr. of Synthetic Rubber						—15,000
(c) Increase in Butylene Polymerization or Butane Rejections Caused by Local Unbalanced Situations						— 8,000
(d) Butylene for Miscellaneous Synthetics						— 1,000
Total New Butane and Butylene Withdrawals						—57,000
Post-War Motor Gasoline	2,000,000	10.0	22.4	68.6		—20,000

ing processes are compared in Table 2. For purpose at hand the significant difference is that per unit 10 lb RVP gasoline made by catalytic cracking produces over twice as much excess butane. It is also of interest to note that there is a relatively small difference in front end volatility of the 10 lb RVP, 400° E.P. gasoline.

Butylene and Isobutane Requirements For Aviation Alkylate

The two highly controversial issues of quantity and quality of postwar aviation gasoline must be faced in estimating the butylene and isobutane requirements for aviation alkylate. Brown and Barnard[3] postulate that postwar civil and military aviation requirements may each be 50,000 b/d. Burrill[4] agrees quite well with the total of 100,000 b/d. Economic considerations are expected to limit the quality of a substantial portion of this fuel to a level that would require little or no alkylate. Perhaps 50,000 b/d may be of the present 100-octane or a higher quality which would be required primarily for military and long range commercial operations. It appears quite certain that at least a portion of this fuel will be of quality substantially higher than the present 100-octane number product.

An alkylate production of 25,000 b/d would permit making 30,000 b/d of 100 octane gasoline and 20,000 b/d of a super fuel; 35,000 b/d of alkylate would presumably permit making the entire 50,000 b/d as superfuel. It therefore appears reasonable to postulate an isobutane and butylene requirement of 33,000 b/d corresponding to 25,000 b/d of alkylate and it appears certain that the requirement would not exceed 50,000 b/d of isobutane butylene corresponding to 38,000 b/d of alkylate.

It might be pointed out that unbalanced vapor pressure situations in some refineries coupled with already constructed alkylation capacity may result in producing "cheap" alkylate that could be used to force upgrading of the price competitive, lower quality aviation fuels. Although this would tend to increase alkylate usage in aviation fuels, the effect on the nation's butane balance would be small because the distress butanes in these particular refineries would have to be disposed of in one way or another.

There is little possibility that butylene alkylate will soon be displaced as the backbone of high quality aviation fuels. The equipment for its manufacture is already installed and aviation fuels meeting any of the quality levels now under consideration for volume use can be blended more cheaply with butylene alkylate than with any other hydrocarbon.

Butane and Butylene Requirements For Synthetic Rubber

The synthetic rubber program now under construction includes the following:

	Long tons per year
Buna S from butane	82,000
Buna S from butylene	317,000
Total Buna S from B-B	399,000
Butyl from isobutylene	75,000

To produce 399,000 tons/year of Buna S from butane and butylene plus 75,000 tons/year of butyl from isobutylene would require approximately 30,000 b/d of butane-butylene. The authors are aware of no forecasts regarding the extent to which synthetic rubber will be produced in the postwar period, but a few already published views are significant:

(a) Buna S from petroleum sources will be cheaper than Buna S from alcohol and may be competitive with natural rubber.

(b) Postwar world-wide rubber demands may reach 2,000,000 tons/year of which one-half may be synthetic.

(c) Special properties of butyl rubber are expected to assure it some postwar production.

Demands for synthetic rubber may well continue at a high level in the early postwar period while depleted civilian stocks are replenished and the natural rubber supply is being re-established. It appears reasonable to assume that total production from petroleum sources would be at least 250,000 tons/year which would require approximately 15,000 b/d of butane-butylene. It is quite conceivable, however, that the equipment for producing butadiene from butane and butylene might be run at capacity in which case the butane-butylene requirements would be near 30,000 b/d.

Increase in Polymerization or Rejection Of Butanes Caused by Local Unbalanced Situations

Although Table 1 indicates that on the average the new uses for butanes may exceed the new production of butanes brought about by catalytic cracking, the situations in individual refineries may deviate markedly from the average. A refiner who is operating the maximum amount of catalytic cracking may find that the demands on his refinery for alkylate, butylene for synthetic rubber, etc., are not sufficient to consume all the butanes he is producing in excess of the amount incorporable in his motor gasoline. He will then have to dispose of his net surplus butanes by shipping them to another refiner who is short of butanes, converting them to motor polymer or alkylate, or rejecting them to fuel (which might be liquefied petroleum gas). It was mentioned above that he might make alkylate to force quality competition in aviation gasoline. It is difficult to estimate how much these distress butanes will amount to, but at least it is certain that they will be some fraction of the net total new butanes production of 37,000 b/d. A reasonable assumption might be one-fifth of this amount, or 8000 b/d.

Butylene Requirements For Synthetics and Chemicals

The extent of expansion during the war period in the field of chemicals, high molecular weight polymers, etc., from butylenes is not known, but cannot be a significant factor in the overall butane picture. One thousand b/d of butylene would produce in the order of 10,000,000 gallons per year of chemicals or heavy polymers. Expansion has probably been less than this amount. Indications are that the use of butanes and other light hydrocarbons in the chemicals field will expand in the postwar period but there is no immediate prospect that the demand will be an important part of the total available.

Effect of Possible Changes in Motor Gasoline Specifications

The above discussion indicates that the following average effects will result from the new processes:

a) A negligible increase in front end volatility of motor gasoline as measured by per cent evaporated at 158°F.

b) An increase in average motor method octane number (unleaded) of about 2.6 units.

c) New butane-butylene consumption will probably exceed new production by about 20,000 b/d but may be as much as 50,000 b/d or may be substantially equal.

d) The ability to and desirability of incorporating all available pentane and heavier hydrocarbons into motor gasoline

[3] Refiner, December 1943, p. 83.
[4] Presented before the Petroleum Section of AIMME, New York, February, 1944.

TABLE 2—Typical Yields and Product Inspection of Products from Catalytic and Thermal Cracking

	Catalytic Cracking	Thermal Cracking
Gas Oil Charge	100.0	100.0
Gasoline—10 lb. RVP	43.5	61.0
Excess Butane (Above 10 lb. Gasoline)	6.5	4.0
Catalytic Gas Oil	46.0	....
Fuel Oil	....	28.0
Gas—FOE*	6.0	12.0
Coke—FOE	4.0	....
	106.0	105.0
Excess Butane—% on 10 Lb. RVP Gasoline	15.0	6.5
Properties of 10 Lb. RVP Gasoline		
% Evap. at 158°F.	25.0	23.0
End Point, °F.	400	400
Octane No.—Motor Method Unleaded	80	68

*Fuel oil equivalent.

Crude Distillation
Thermofor Catalytic Cracking
Houdry Catalytic Cracking
Polyforming
Selective Cracking
Viscosity Breaking
Coking
Vacuum Distillation
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PETROLEUM REFINING PLANTS

will not be affected.

Since in 1940 approximately 75,000 b/d of recoverable butane were burned as fuel, it appears that in the postwar period significant amounts of butane will also be burned as fuel. This would indeed be unfortunate if we are really facing a shortage of crude oil, and a rising price of crude would bring to bear economic incentive to use butane for something besides refinery fuel. One of the simplest means (to the *motor fuel* manufacturer) of effecting better utilization of butane is to increase the allowable vapor pressure of motor gasoline. An increase of only two pounds RVP would make possible incorporating approximately 70,000 b/d more butane in 2,000,000 b/d of motor gasoline. Front end volatility would be increased by approximately 4% at 158°F.

Changing motor gasoline end point can also produce a marked effect on the light ends balance. Lowering end point decreases yield of gasoline on crude, improves gasoline volatility, decreases TEL requirements, increases production of light ends, and decreases the percentage of butane incorporable in gasoline. With the exception of the decrease in TEL requirements and volatility, all these effects are to the disadvantage of the refiner. The new processes have introduced one effect bearing on this situation; the heavy ends of catalytically cracked gasoline are much better in octane number than the heavy ends of thermally cracked gasoline. This difference, together with a possible increase in crude price, will increase the economic incentive to raise end points and therefore decrease light end production.

Motor Gasoline Volatility Limits

While the foregoing discussion indicates that the average effect of large scale catalytic cracking upon motor gasoline front end volatility will be quite small, it is possible that there may be an increased incentive toward substantial front end volatility increases by some manufacturers. Of course, there is nothing really new in this situation as there have always been local instances of surplus light end material. However, because of the possibility that the number of such instances may increase through the application of catalytic cracking and the forcing of thermal cracking operations, it seems sound to review the limitations to increasing light end utilization in motor gasoline. It is recognized that there undoubtedly will be wide disagreement with the writers' conclusions in many instances, but it is felt that they are justified on the grounds that now is the time to consider those aspects of the fuel volatility problem which require coordination with car design, as probably never again will the industry have the opportunity of such extensive obsolescence of the equipment in service.

Vapor Pressure and Vapor Lock

The previous discussion has pointed out the advantages to the fuel manufacturer of a 2 lb relaxing of average vapor pressure limits. Even a 1 lb higher average vapor pressure would be quite advantageous from the standpoint of incorporating butanes in motor fuel. However, no performance advantage accrues from increasing vapor pressure per se, although C_4's are generally high in octane number and, to the extent that they can be incorporated, are equivalent to the addition of approximately 100 octane number base stock. (As a matter of fact, R. C. Alden long ago pointed out that the manufacture of alkylate is in reality a vapor pressure reducing process, as the butane charge to the process has about the same octane number as the finished product, the principal difference being a reduction in vapor pressure from the neighborhood of 60 lb to about 2 lb).

The present federal specification for vapor pressure limits have been in effect since 1931, and subsequent experience has indicated that they may not be relaxed materially if the requirements of equipment in present use are to be met. True, vapor lock troubles in modern passenger car equipment are infrequent and even many of the older cars have been revamped to the point where they are no longer as critical as they were initially. For example, the first fuel pumps, which were subject to vapor lock, contained ball check valves and diaphragms that deteriorated quite rapidly. Replacement has virtually eliminated these older pumps and the attendant vapor lock as well as mechanical difficulties. There are many other instances in which replacements made in the course of maintenance have corrected minor mechanical ailments which gave considerable difficulty at first.

Probably the biggest stumbling block to any immediate consideration of a vapor pressure increase is the commercial vehicle situation. Gasolines made to present vapor pressure limits are definitely unsatisfactory in many of the larger units. In particular, 12 lb winter gasolines are prone to vapor lock in the heavier trucks and buses. Accordingly, it appears that from the standpoint of commercial vehicle requirements, no increase in vapor pressure can be granted at this time, nor are the prospects too encouraging for a change in this situation in the early postwar period. Mechanical problems of combating vapor locking tendency are frequently of a baffling nature —a further discussion of which will follow.

By and large, it seems that any consideration of an increase in vapor pressure limits must contemplate the virtual necessity for separating commercial vehicle fuels from those for use in passenger cars. It simply does not appear in the cards to operate the heavier commercial and industrial vehicles on gasoline of higher vapor pressure than has been manufactured in the past.

Many discussers of the vapor lock question, particularly from the point of view of the fuel manufacturer, have claimed that comparatively simple and cheap modifications of automobile fuel systems would permit the handling of higher vapor pressure fuels and thereby prevent the waste of valuable light end fractions. It is perfectly true that instances have occurred in which a design has been unnecessarily prone to vapor lock; for example, last minute changes in hood styling have converted an otherwise satisfactory fuel system into one which has given trouble. By and large, such instances constitute the rare exception rather than the rule. An examination of the cars turned out during the last few prewar years will show plainly that much effort has been devoted to making those cars as free from vapor lock tendency as possible.

The critics of the automobile designer have failed to take into consideration other questions which are at least as important as increasing vapor pressure tolerance. The very early automobiles were practically all equipped with fuel systems which would never vapor lock. Indeed, during the first decade the "horseless carriages" operated on gasolines of very high volatility which would undoubtedly vapor lock severely in almost any modern car. The fuel systems were very simple; the tank was under the seat, or, possibly, in the bonnet with a direct gravity feed to a vaporizing type "carburetor." It is probable that no Model "T" ever suffered from vapor lock, nor, for that matter, did any car with its fuel tank mounted above the engine level with a direct gravity feed to the carburetor.

Comments concerning the fire hazard of such fuel systems appear superfluous, in addition to which the inconvenience and messiness of the refueling operation are quite unacceptable. The tank must be at the rear of the car, it must be possible to refuel without annoying occupants or damaging the car through spillage or hose manipulation, and there can be no large quantity of fuel under positive pressure in either the tank or supply system. Any desire on the part of the designer to employ high pressures for vapor lock prevention must be tempered by consideration of the possible fire hazard.

As to temperature control, he is definitely up against some very serious problems as he ordinarily has no positive cooling medium at his disposal and he can only avoid subjecting the fuel system to excessively high temperatures. This is particularly emphasized in the case of commercial vehicles where vapor lock in the fuel supply system has usually been carefully avoided, but in which the large amounts of engine heat liberated result in a problem of carburetor

vapor lock for which there appears to be no ready solution. Many carburetor vapor locking difficulties are associated with the large amounts of heat stored up in massive cast iron exhaust manifolds and transferred to the adjacent carburetor when the throttle is closed and the cooling flow of air through the carburetor is at a low ebb.

Other Volatility Limits

End point changes do not materially affect the automobile engine unless they become excessively high—usually well outside the gasoline range. It is fair to assume that such changes will not occur as the result of catalytic cracking installations. It should be remembered, however, that very high end points mean that such heavy fractions will simply pass through the conventional engine unburned.

That there are limits to front end volatility other than vapor locking appears not to be very widely appreciated. Of course, it is known that there are limits below which starting becomes difficult; the need for protracted use of the choke interferes with fuel economy, etc. However, there are high limits to gasoline volatility which are quite important, but which, in many instances, result in problems which are not too easily recognized. One practical problem is that introduced by the automatic choke. There is every reason to believe that the automatic choke is here to stay as, for passenger cars, it generally does a better job than does the manual choke in the hands of the ordinary driver and it is a necessary complement to the automatic transmission. Further, as long as the automobile is essentially a convenience and not a mere utility vehicle, mechanical complications for the purpose of simplifying the driver's duties are likely to increase rather than to diminish. Obviously, any form of an automatic choke must be calibrated against certain fairly definite fuel characteristics. For an automatic choke to perform successfully the front end volatility of the fuel must be reasonably high and, by and large, it should be higher in the winter time than in summer.

On the other hand, very high front end volatility, assuming that the choke may not be eliminated altogether, seriously interferes with the operation of any such device which must be calibrated for "average" volatility. In particular, if the choke is calibrated against gasolines averaging, say, 22% evaporated at 158°F., it will, of necessity, supply undesirably overrich mixtures when forced to operate on fuels having much larger amounts evaporated at 158°F. In the more extreme cases, difficulties have been encountered in which the carburetor would flood, particularly when attempting to start with a partially warm engine. This problem, of course, is associated with the incorporation of pentane and hexane fractions, rather than butanes and, therefore, is not closely related to the subject at hand unless butanes are much more extensively used. It does emphasize, however, the necessity for keeping gasoline characteristics within bounds and avoiding the manufacture of any fuel which departs too far from the characteristics of those generally marketed merely because it may appear superficially that, if a certain amount of a given property is advantageous, a larger amount must, of necessity, make the product still better.

Another problem associated with excessive front end volatility is less widely appreciated than the foregoing: carburetor icing. Ice formation in jets and on the throttle butterfly is a phenomenon which apparently cannot be entirely avoided in any simple aspirating type of carburetor. Every engine which may be cooled to temperatures below 40°F. is subject to possible carburetor ice formation. It is primarily a "weather" phenomenon and the atmospheric condition most conducive is that in which the temperature is slightly above 32°F. with high relative humidity. Under such circumstances fuel evaporation produces the refrigeration necessary to drop temperatures below 32°F. and to freeze the relatively considerable moisture content of the air passing through the carburetor. One of the most annoying manifestations of this phenomenon is the formation of ice pellets on the air bled idling jets. In this instance, the engine may function normally under power but will die whenever the throttle is closed. (And good idle performance is essential to the operation of any automatic transmission.)

Throttle or venturi ice formation is less prevalent, but when it does occur it may make the engine virtually inoperable. Obviously, this is a situation through which the engine will pass fairly rapidly—for as soon as sufficient engine heat becomes available to raise manifold and carburetor temperatures above the critical range the ice will disappear and operation become normal. Usually the effects of ice formation become most pronounced after a car has been driven about one mile from a cold start under atmospheric conditions approximating those mentioned above. Several more miles will, of course, serve to warm things up enough so that ice will no longer be troublesome.

By and large, the problem of ice formation may be appraised as being due principally to atmospheric conditions, and, as far as fuel characteristics are concerned, it is probably a matter of excessive pentane content rather than high butane content—at least with gasoline as manufactured at present. It should be taken into account, however, when considering raising vapor pressure limits for the purpose of substantially increasing butane content.

The writers have risked stepping out of their field to offer the foregoing comments on the vehicle designers problems. These comments are submitted not to indicate that the situation is regarded as hopeless, but rather to point out that it is not a simple one and that if an increase in vapor pressure tolerance appears really important the appropriate investigation should be initiated as soon as possible. This discussion should not be taken as indicating that the writers urge the initiation of a study of the vapor lock problem with a view to developing ways and means for relaxing vapor pressure specifications. However, if the industry, as a whole, can appraise this problem as being sufficiently important it would appear that its study should be initiated without undue delay. The Co-ordinating Research Council represents the interests of both industries in matters of this sort which require cooperative effort by both automotive design and petroleum manufacturing groups. The question, therefore, might be referred to the Council.

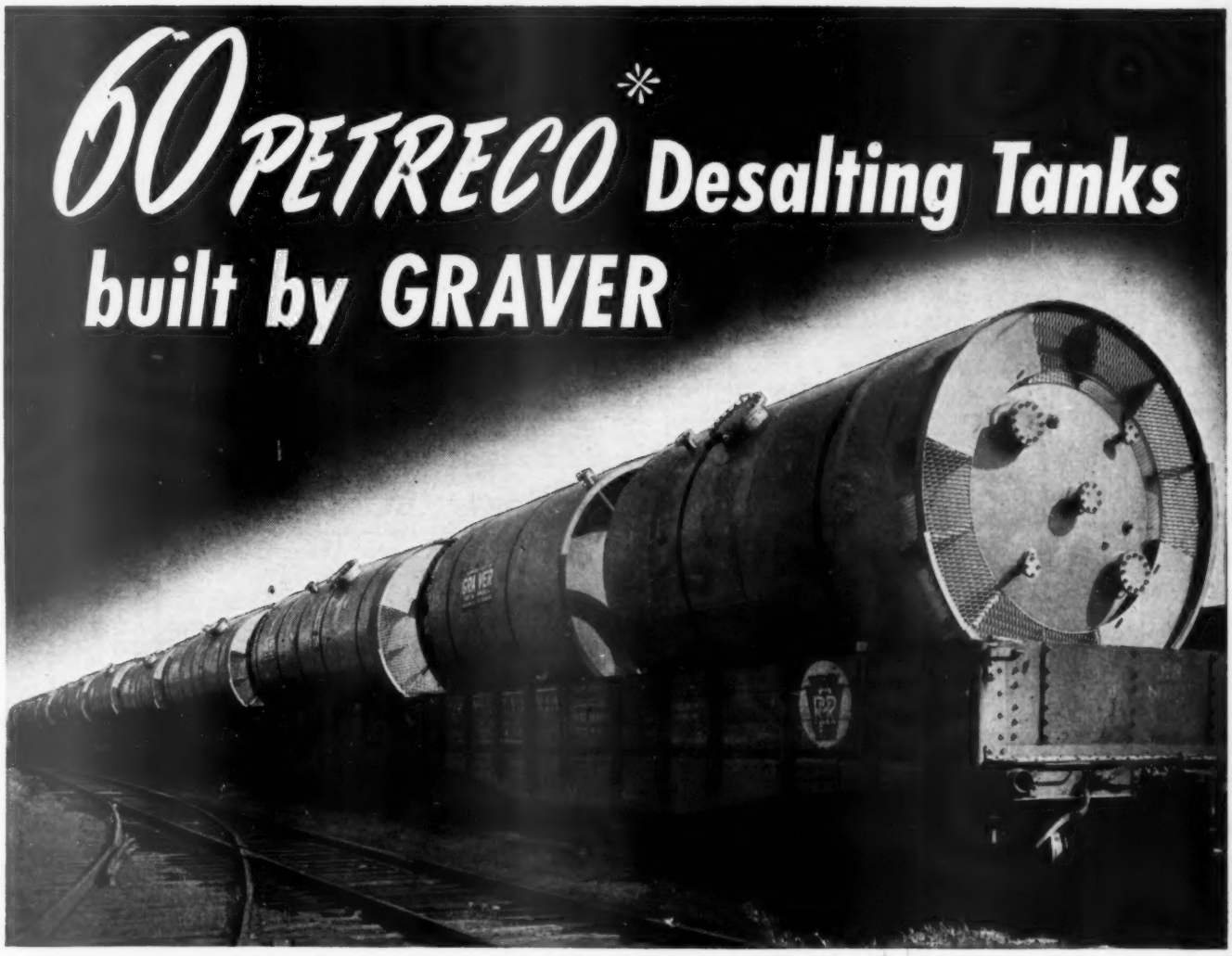
Conclusion

The national butane balance will not be greatly changed by the introduction of the new facilities constructed during the war. It is true that the extensive catalytic cracking operations will produce greater amounts of butanes than heretofore, but it is also true that there will be increased uses for such butanes. The indicated net result is that the new consumption will exceed the new production—but not by an amount sufficient to make possible utilizing all recoverable butanes for purposes other than fuel.

No great change in average front end motor gasoline volatility is to be anticipated from the various combined factors, although local instances of large front end volatility increase may develop. It is emphasized that front end volatility must be kept within reasonable limits if best results are to be obtained by the gasoline user.

Butanes from natural gasoline sources will apparently have at least as large a field of use as before the war, but there will probably still be substantial amounts that can find no use other than as refinery fuel. To the extent that larger amounts of C_4 fractions can be incorporated in motor gasolines, they should be so used in the interest of crude conservation, but they must be used judiciously. It must be remembered that a reasonable degree of uniformity of motor fuels is essential, particularly in volatility characteristics, if the automobile industry is to produce vehicles which will utilize gasolines most efficiently and with freedom from those difficulties associated with fuel properties. If it appears that relaxing of present vapor pressure limits of motor gasoline to make possible utilization of surplus butanes is of sufficient advantage, the question should be considered thoroughly and promptly by both the petroleum and automotive industries.

60 PETRECO* Desalting Tanks built by GRAVER



The above photo includes only a portion of this shipment of 60 Petreco Desalting Tanks. Each tank measures 10 ft. 7 inches high, and weighs 13,975 lbs. They are designed for 62 lbs. working pressure.

. . . take off for the production front

Built by Graver, an order comprising 30 carloads of Petreco Desalting Tanks is, in part, shown here in transit . . . on their way to help speed the production of petroleum products.

Very definitely an order of this size gives strong evidence of Graver capacity and ability to serve the Petroleum Industry adequately and correctly in the fabrication of steel plate equipment.

Graver's long record of achievement in building fractionating towers, pressure vessels, storage tanks and spheres, expansion roof tanks, and similar steel plate equipment is your assurance that any job handled here, whether large or small, will measure up to the most exacting specifications and be produced at a minimum of cost.

Your inquiry is invited . . . and without obligation.

GRAVER
FABRICATED STEEL PLATE EQUIPMENT

**Petreco is the trade name of the Petroleum Rectifying Company, who designed and furnished this equipment.*

Fabricated Steel Plate Division
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4811-17 Tod Ave., East Chicago, Ind.
NEW YORK CATASAUQUA, PA. CHICAGO TULSA

Simplified Flow Diagram for Standard Design of Synthetic Rubber Plant

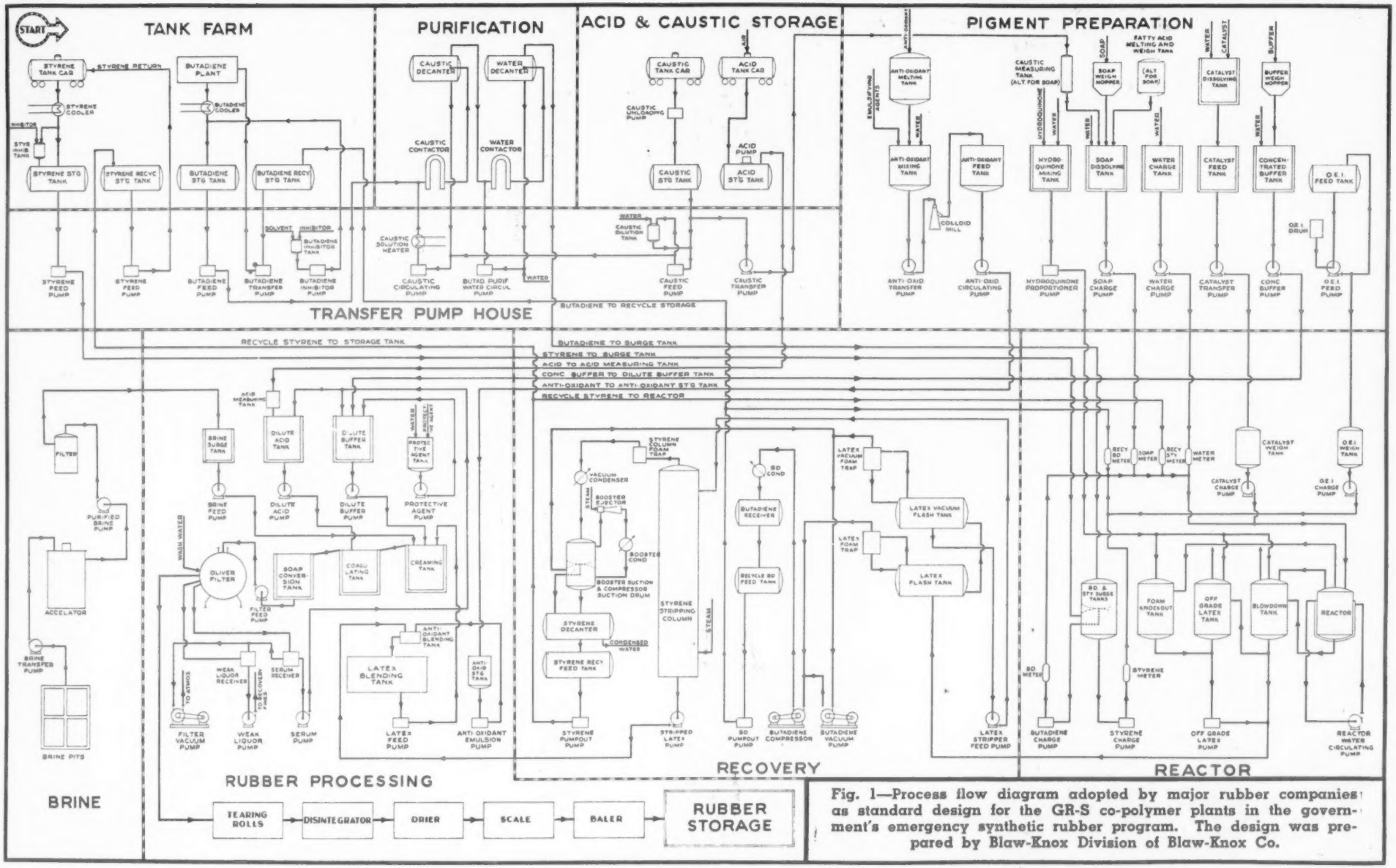


Fig. 1—Process flow diagram adopted by major rubber companies as standard design for the GR-S co-polymer plants in the government's emergency synthetic rubber program. The design was prepared by Blaw-Knox Division of Blaw-Knox Co.

PROCESS DESIGN for the SYNTHETIC RUBBER PLANTS

Various factors involved in the design of the GR-S co-polymer plants for the national synthetic rubber program are discussed, together with the design features adopted to meet the specific conditions. Segregation of hazardous and non-hazardous areas of the plant was required, with different types of construction for buildings. Restrictions on the use of steel led to the employment of reinforced concrete in structural design.

Steel plate vessels with enamel or glass linings were designed to avoid the use of critical corrosion-resisting metals. Electrical installations likewise were designed under strict limitation orders involving critical materials, to meet conditions created through the presence of explosive vapors. Pumping facilities were installed to avoid possibility of vapor locking due to the high vapor pressure of butadiene at ordinary temperatures.

*By G. E. Kopetz**

SYNTHETIC rubber was not entirely new to the U. S. at the time Japanese aggression cut off the major sources of natural rubber. There had been limited production of special types of synthetic rubbers which were more suitable than the natural product for certain specialized uses. At the same time, the leading rubber companies also had become interested in developing a process for a synthetic rubber capable of being substituted for natural rubber in general.

Early in 1941 the Blaw-Knox division of Blaw-Knox Co. was employed to engineer and construct the first large scale plants for production of the Buna-S type of synthetic rubber, now known as GR-S. After Pearl Harbor, to meet the war emergency, the major rubber companies of the nation adopted a standard design, prepared by this company with the cooperation of rubber company and government experts, to be used throughout the national synthetic rubber program. Blaw-Knox Co. also standardized procurement for the national program and, in addition, installed the process equipment in six of the new synthetic rubber industry's plants. The simplified process flow diagram, shown in Fig. 1, illustrates the method of operation.

← Fig. 1

Buna-S is a co-polymer of the hydrocarbons butadiene and styrene. These materials are received either by pumping from an adjacent hydrocarbon manufacturing plant or in tank cars from such a plant located at a distance. As received, both butadiene and styrene contain an inhibitor. In the case of butadiene, the inhibitor is removed by treatment with caustic soda solution. The butadiene and styrene are then charged into reactors, together with catalyst, chain modifier, soap solution and water. The mixture is heated and agitated to cause polymerization of the hydrocarbons. The resulting co-polymer forms an emulsion called "latex," similar to natural rubber latex.

It is not customary to carry the reaction to completion, and therefore the latex discharged from the reactors contains unreacted hydrocarbons which are removed and recovered in the recovery system. Butadiene is removed in the flash tanks, after which the latex is stripped with steam in the styrene stripping columns to remove styrene. The butadiene and styrene are condensed for re-use and the stripped latex is pumped through blending tanks, where antioxidant is added, and then goes to storage.

The latex is then transferred to the latex creaming tank, where brine solution is added. A protective colloid may also be used if desired. From the creaming tank the latex flows to the coagulating tanks, where dilute sulfuric acid is added, and then flows to the soap conversion tanks, where conversion of soap to fatty acid takes place. This chemical treatment of the latex causes the emulsified rubber particles to cohere and form larger masses which are readily separable from the liquid.

The slurry is pumped from the conversion tank to Oliver filters for removal of liquid and washing. The filter cake is shredded by means of a disintegrator and fed to a steam heated dryer employing forced circulation for moisture removal.

The dried crumb is discharged to a batch for uniform sizing of the compressed rubber bales that are formed by means of an automatic hydraulic press. The finished bales of uniform size and weight are packaged and suitably marked for identification purposes.

The magnitude and scope of such an engineering endeavor was unparalleled in the history of the rubber industry, for at the inception of the commercial design little information was available pertaining to such characteristics of the polymerization reaction as exothermic heat release, reaction rates and yields. In addition to the great quantity of required design data, the problem was further complicated by limitation orders, priorities, manpower shortage and, most important, immediate deliveries required for a paramount defense industry. However, the production curves shown in Fig. 2 evidence the fact that exceptional progress was made not only in design but also in construction. This curve compares process equipment tonnage with the time involved in installation. The corresponding cost is likewise shown.

Plant Layout

Moving into a large-scale synthetic rubber program, the difficulties of design became more evident when an attempt was made to design a standard plant having a rated capacity of 30,000 long tons of synthetic rubber per year, with the identity of the plant site lacking.

The complexity of the problem becomes even more apparent when it is realized that 375 tons of process piping, 400 tons of mechanical equipment, and 800 tons of process equipment are necessary for each 30,000-ton plant, requiring buildings covering 120,000 square feet, or almost three acres of ground area.

The 30,000-ton plant referred to above consists of two separate 15,000-ton units. This smaller size of unit was the result of an extensive analysis of equipment that was readily available, as well as the most economical from the standpoint of flexibility and design. A typical plant is shown in Fig. 3, having a rated capacity of 90,000 long tons per year.

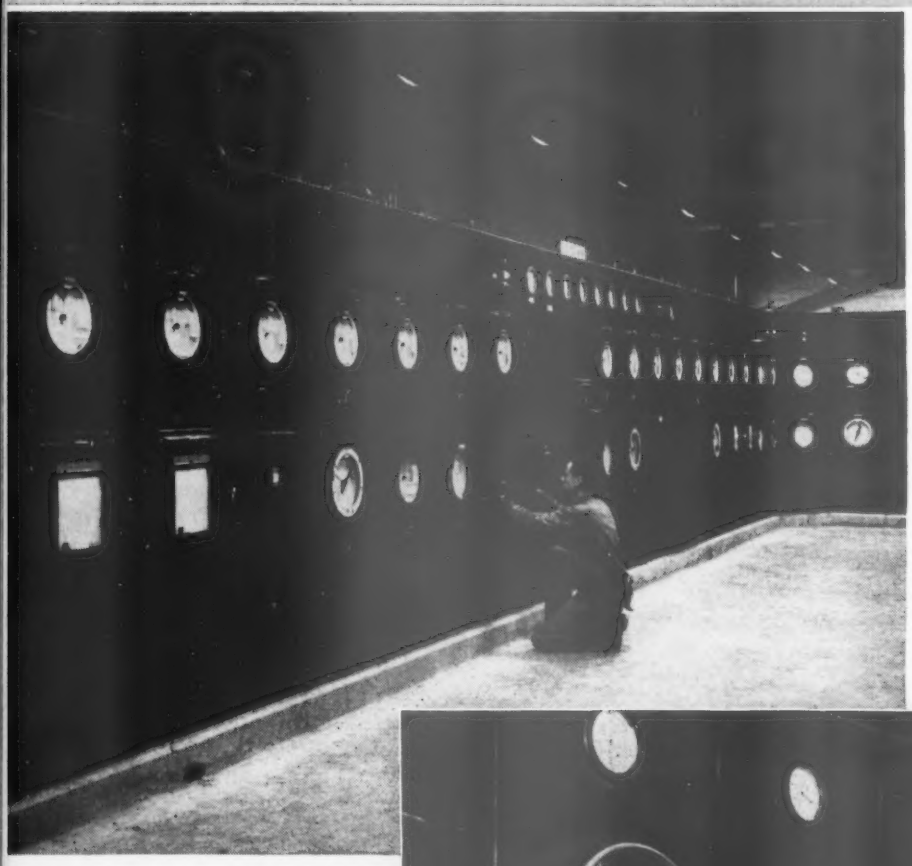
It was immediately apparent that segregation of hazardous and non-hazardous areas should be made for economical reasons. The buildings in the hazardous areas were made totally fire-proof, utilizing explosion-proof electrical equipment. In the non-hazardous areas only partial fireproofing was resorted to, employing standard electrical equipment throughout. Moreover, from the standpoint of safety this segregation permitted the location of the hazardous areas in such a fashion that any possible fires could be reasonably confined. This arrangement obviously held considerable merit in the light of the fact that bombing raids would be entirely possible during wartime. It was, therefore, possible to complete the drawings for any one building and commence erection long before a final design had been originated for an entire plant. As a result of this latter circumstance, a substantial saving in time resulted.

Structural Design

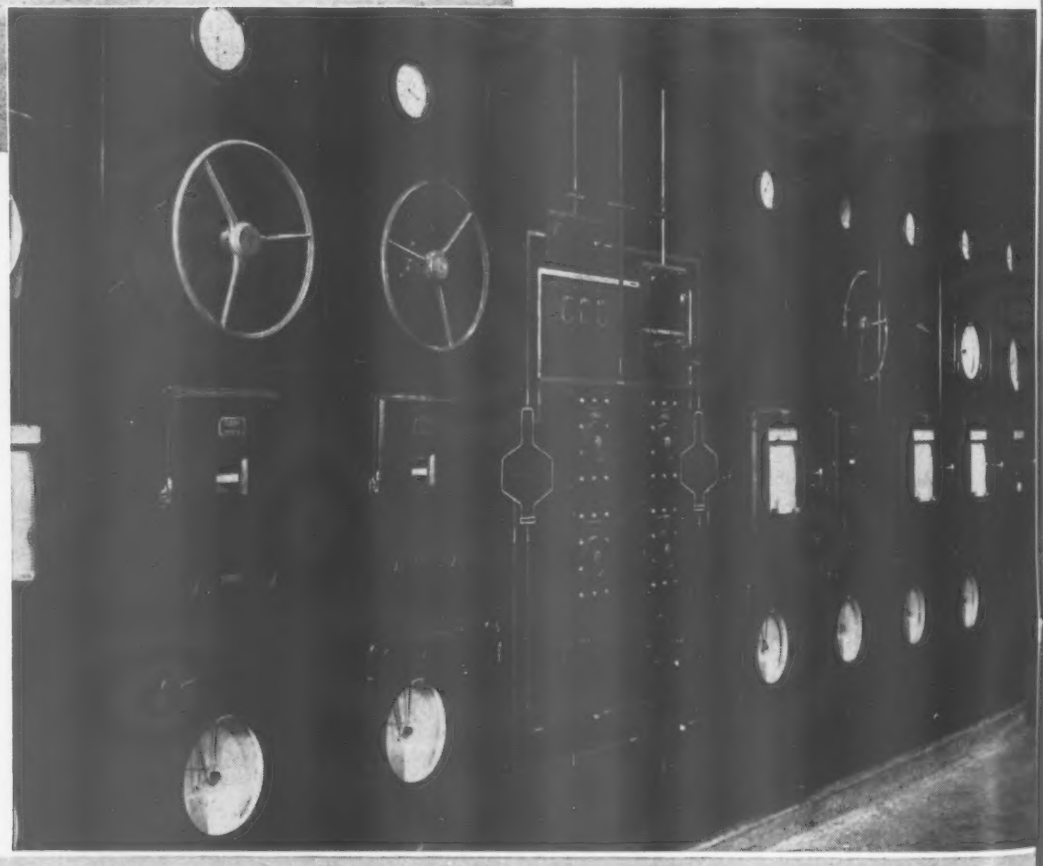
On account of limitation orders restricting the use of steel, reinforced concrete was employed in the structural design throughout the entire program. Since concrete was a non-critical, fire-

*Blaw-Knox Construction Co., Pittsburgh.

"Commandeered"



CORNER of panel in one of three large control rooms at Port Neches, showing 20 of the 240 Model 30 Stabilog Controllers for flow and pressure.



ANOTHER section of control panel showing, at left center, wo of the 32 Stabilog Potentio-neter Controllers which enable peration of temperature proc-esses within very narrow margins.

Stabilog
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Controllers with HYPER-RESET

---to control both units of the Port Neches Butadiene Plant!

IN designing the world's largest butadiene plant, the Neches Butane Products Company faced one of the toughest control jobs ever tackled. Even the initial step of obtaining pure normal butylene was complicated by the hairline differential between its boiling point and those of accompanying hydrocarbons.

Foxboro Instruments were specified for the vast majority of control jobs in this plant . . . and were assigned WPB priorities among the highest of any wartime projects! More than 320 Foxboro Instruments, including 272 Stabilog Controllers, now automatically control this operation, from the input gathering pipelines to the final delivery of purified butadiene!

This important new installation is merely another example of the petroleum industry's preference for control systems based on the famous Stabilog Controller. For more than 15 years, Foxboro's Stabilog Controller has been the leading stabilizing controller.

Today, with the additional refinement of HYPER-RESET, Stabilog Controllers deliver process stability never even approached before!

Write for detailed Stabilog Controller Bulletin A-330. **The Foxboro Company, 56 Neponset Ave., Foxboro, Massachusetts, U. S. A.** Branches in principal cities.

Every step in the flow through this plant is handled by automatic control instruments. Foxboro supplied the majority of these instruments . . . over 320, in all.

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ARMY E NAVY

proof, and corrosive resistant material, it satisfied a vital three-fold emergency requirement.

In the design of the reinforced concrete structures, various types of loading conditions were investigated. First, dead load plus wind on the sides of a totally enclosed building; second, operation load plus full live load, plus wind load; and third, full test load, without wind. This latter condition supplied the maximum foundation loads because the process system is operated only partially filled, whereas the test is based on equipment filled with water. The structures were designed as a rigid frame using the moment distribution method. A typical 30,000-ton reinforced concrete recovery structure is shown in Fig. 4.

In order to recover fine rubber particles from the filter wash water the Dorr Vacuator System was employed. This process consists of an aeration of the liquid followed by exposure to vacuum which results in flotation of the aerated particles, thus permitting their removal by mechanical means. The vacuum tank in which this operation is performed is termed a "Vacuator," and is constructed with reinforced concrete having a specified 4000 lbs per sq. in., 28-day ultimate strength with a 2 in. maximum slump. Operating data show that concrete has been entirely satisfactory for the construction of such a vacuum tank for a vacuum as high as 12 in. The largest recovery system designed employed a round Vacuator tank having a diameter of 40 ft-0 in., with a dome roof that was supported only by the tank wall.

Use also was made of concrete for tanks storing latex. Tanks constructed of wood proved highly satisfactory in a number of instances where corrosion problems would have required special coating for steel tanks. Wood tanks had an immediate delivery date as well as having a relatively low cost, and could be procured in standard sizes.

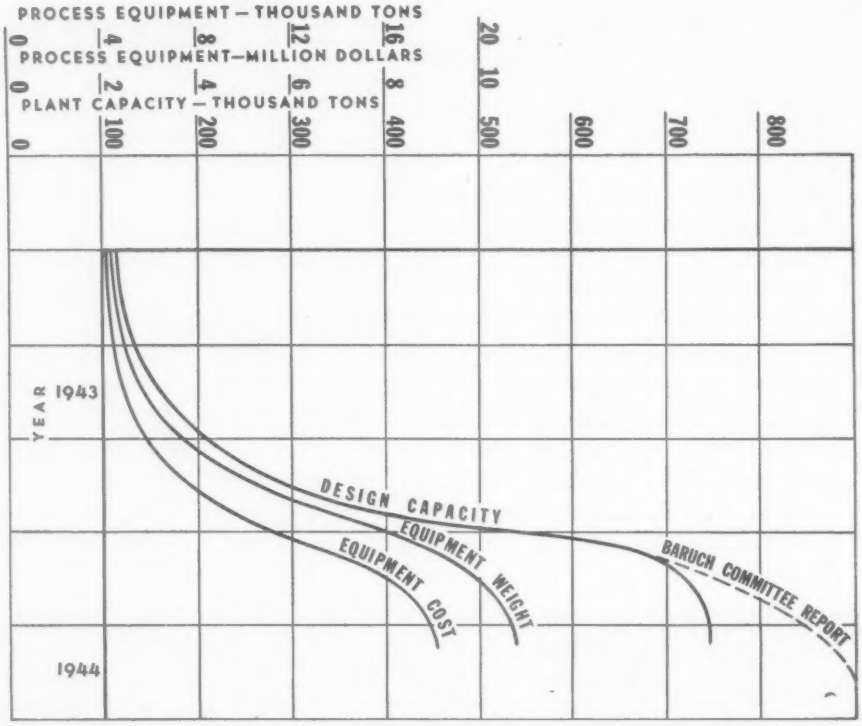


Fig. 2—Comparison of tonnage of rubber plant process equipment installed with time required for installation. Corresponding cost is likewise shown.

Vessel Fabrication

In order to avoid the use of critical corrosion-resisting metals, steel plate vessels with enamel or glass linings were designed and were found to operate satisfactorily. For the recovery of the unreacted styrene from latex a steam stripping operation is carried out in a tray column. As perforated trays are preferable to bubble cap trays where possible clogging of the trays has to be considered, a perforated tray was designed for this purpose, using light gauge steel having a glass coating. By means of stud bolts, precise leveling of these trays was made possible, thereby eliminating the unevenness resulting from warping during the glass-coating operation. It was found that this coating reduced the accumulation of material on the trays and made it easier to remove such material as it does not readily adhere to glass. These trays were developed for sectional fabrication and assembly. The columns were designed for full vacuum and 15 psi gauge pressure, and are 9 ft. outside diameter by 49 ft-6 in. in overall height. Adjustable flow weirs control the liquid height on each tray, thus permitting of adjustment for maximum stripping efficiency.

As evidenced from the flow sheets, a large amount of heat exchange equipment is required. On the larger units, cast iron water boxes were used successfully as a means of alleviating the critical material shortage. Steel was used on the smaller units, which were selected according to available stock sizes.

Notwithstanding the fact that the first polymerization reactors were fabricated from stainless clad steel plate using stainless steel agitators and shafts, excellent results were obtained using glass lined steel reactors with chromium plated rotating parts. These reactors have a capacity of 3750 gal. and are designed in accordance with Sect. 8, Par. U-69 of the A.S.M.E. Boiler Construction Code. Typical standard arrangement of these reactors is shown in Fig. 5.

Mechanical seals were selected in lieu of the packed stuffing-box arrangement for the agitator shafts on the reactors and

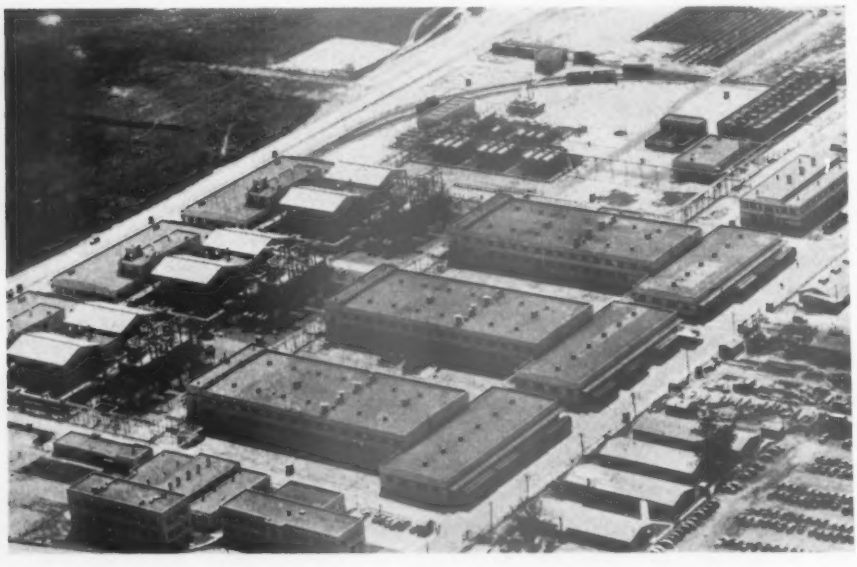


Fig. 3—Typical GR-S rubber plant having three 30,000-ton standard units

Cooling Tower DOs and DON'Ts
-by MARLEY (No. 2 of a series)

SYSTEMATIC INSPECTION

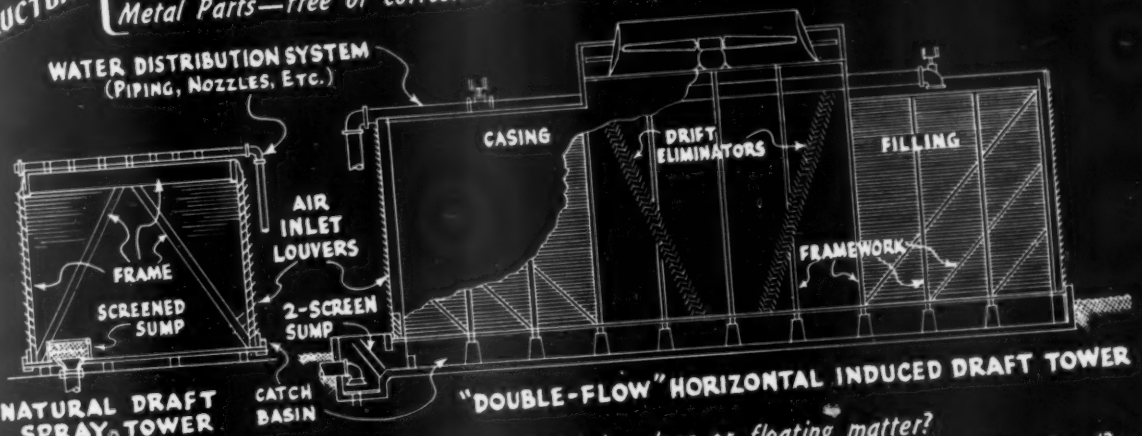
Maintenance time and expense can be minimized and all but routine repairs and shut-downs can be avoided by careful regular inspection. A definite and frequent schedule should be observed —daily for large mechanical draft towers, weekly for small natural draft types.

A thorough monthly check-up should answer these questions:

WATER DISTRIBUTION SYSTEM
- Supply Piping and Headers—free of obstructions and leaks?
- Regulating Valves—operate freely when tested?
- Nozzles or other Outlet Orifices—all function uniformly?
- Water Pressure—equal over entire system? (In pipe-and-nozzle systems all branches must show even spray. In gravity-flow systems all flumes, launders or basins must be true and level so water is same depth in all boxes.)

AIR PASSAGES
- Air Inlet Louvers—unobstructed, none sagging or out of place?
- Filling (Decks) and Drift Eliminators—free of obstructions, algea or scale?

STRUCTURE
- Bolts of Frame and Casing—tight? (In wood towers, must permit expansion and contraction. Find cause of casing leaks, frame stress, etc., such as foundation settling.)
- Metal Parts—free of corrosion? Paint needed? (Examine steel towers closely.)



CATCH BASIN
- Basin Water—clean and free of debris, algea or floating matter?
- Float Valve (if one is used on make-up)—work freely? Not leak when closed?
- Sump Screens—in place and clean? Safety Overflow—open and unobstructed?
- Floor and Sidewalls—free of leaks? (In concrete, examine expansion joints. In wood basins dried out during idleness, small leaks close as wood becomes soaked.)

MECHANICAL PARTS
- Metal Parts—clean, well-painted, free of corrosion?
- Fans—rotate freely? In balance? Blade clamps and hub bolts tight?
- Reduction Gears—properly lubricated, operating quietly? No oil leaks? (Slight "play" in gears is normal but, if excessive, indicates wear.)
- Drive Shafts—in alignment and balance? Coupling bolts tight? Guards secure? Universal joints properly lubricated? Motors—properly greased? Not over-heating?

The inspector should report matters requiring attention to the maintenance or operating crew; if of an unusual or serious nature, notify the manufacturer.

MARLEY COOLING TOWERS

24-A

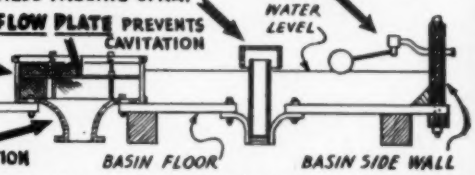
DO YOU KNOW— that these convenient BASIN ACCESSORIES are standard equipment with all Marley basins, redwood or steel.

HIGH SCREEN KEEPS OUT DEBRIS; EACH SECTION INDEPENDENTLY REMOVABLE

BELLED SUMP MINIMIZES WATER TURBULENCE AND FRICTION

OVERFLOW OUTLET PROTECTS AGAINST EXCESSIVE DEPTH OF WATER. "UMBRELLA" SHEDS FALLING SPRAY

AUTOMATIC FLOAT VALVE MAINTAINS CORRECT WATER LEVEL BY CONTROLLING THE ADMISSION OF MAKE-UP READILY ADJUSTABLE



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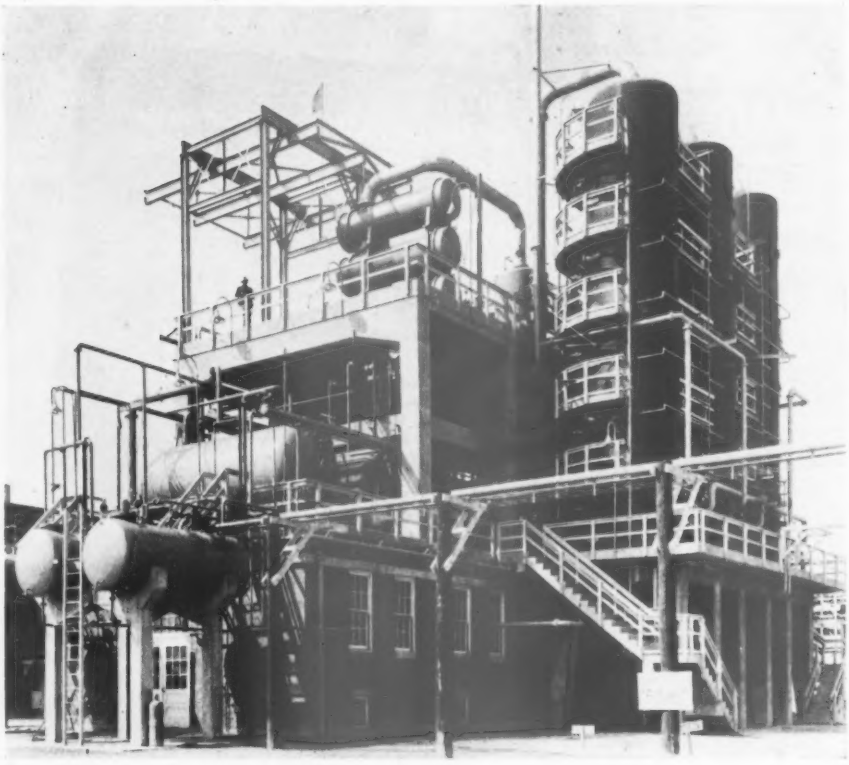


Fig. 4—Structure for processing unit showing use of reinforced concrete in place of steel

blow-down tanks. Each unit has an individual motor driven rotary pump for maintaining oil pressure on the rotating ring in contact with the stationary gland, thereby eliminating any possible danger of the mixture within the reactor accumulating at the contact surfaces. With the ever-present opportunity for power failure, resulting in loss of oil pressure on the system, a special pressure tank was installed with each unit to supply the necessary pressure during such emergency.

The agitator shafts for these reactors consist of short sections employing semi-rigid couplings, thus simplifying their removal and saving headroom over the reactors. To reduce the quantity of machine work required for the drive assembly for these units, slow speed motors driving V-belts were employed, which eliminated the very critical reduction gear arrangement used prior to the standard program.

Sight glasses for inspection during operation are employed, using tempered glasses with mechanical wipers for cleaning. An additional source of light is provided to permit visual inspection of the contents of the vessels while reactions are taking place.

Electrical Equipment

Wartime conditions made it necessary to design and install electrical power and lighting under strict limitation orders involving critical material, particularly copper and steel. These restrictions vitally affected the selection and arrangement of electrical equipment, since explosive vapors are present in 50% of the plant areas, and a greater part of the plant power is required at these points. As a result of this circumstance, all load distribution centers were located in non-hazardous areas adjacent to the hazardous areas at an elevation of 25 ft. above grade. Because of the high specific gravity of the hydrocarbon vapors, the elevation of the load distribution centers above grade results in further reduction of fire hazard. Moreover, this elevation provides additional protection against flood water for such plants as are located in areas subject to floods. Four load distribution centers are pro-

Fig. 5—Arrangement of equipment in reactor area. Tops of reactors are shown at right; at left are blow down tanks

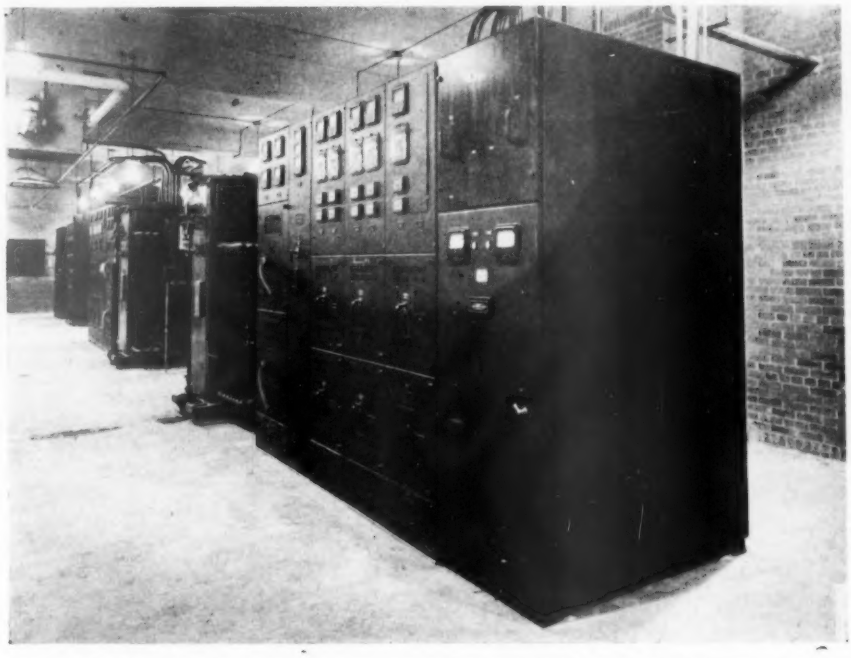


Fig. 6—Substation with synchronous motor starter, switchgear and starter cubicles

vided for each 30,000-ton plant unit, with locations arranged in the most convenient manner. Each load distribution center consists of a 1000-KVA transformer, a 440-volt secondary bus and metal clad switch gear with air circuit breakers, and motor control centers.

Distribution is so arranged that one load distribution center, located in each of the two switch rooms, furnishes power for a 15,000-ton unit. The secondary buses of the load centers in each switch room are tied together through circuit breakers to insure continuity of operation of the process equipment in case of breakdown of any of the feeders or unit sub-stations. All of the power required is furnished from these centers, with each motor remotely controlled, either by push button stations, automatic devices, or interlocking controls. With this arrangement the elimination of explosion-proof starting equipment was made possible, which reduced substantially the quantity of steel that would be required. Voltages were standardized for the entire rubber program at 13,800 volts for the primary, and 440 volts for the secondary, employing 3-phase, 60-cycle current.

Combination full voltage line starters were used exclusively, employing air break magnetic switches with thermal overload devices and air circuit breakers with magnetic trip set for instantaneous short circuit protection only. All motors are standardized at 440 volt employing 110-volt control circuits. Control current is obtained from each motor circuit, with the control circuits installed in the same conduit as the motor power circuits, in an attempt to reduce the amount of steel. However, where such an arrangement was considered unsafe or otherwise impractical, a separate conduit was utilized. A typical unit sub-station and control center installation is shown in Fig. 6.

For regulation of the latex feed to the styrene stripping columns, the motor driven feed pumps are controlled by motor driven Reeves variable speed drives operated by push buttons on the control panel. The speed and the output of the pump are thereby adjusted to obtain the desired flow rate as shown by the flow meter on the control panel. A practically constant removal of the stripped latex from the base of the stripping column is obtained by liquid level control switches on the column operating the speed drives on the latex discharge pumps. A timer is included in the circuit to reduce overcorrection and liquid level regulation by this method is accomplished satisfactorily.

By means of interlocking sequence control on the rubber weighing scale and baler, it was possible to weigh accurately any predetermined amount of rubber and automatically to discharge this quantity to a hydraulic baling machine, in which the dried rubber crumbs are compressed, baled and discharged to a conveyor. Each of these steps in the operation is in accurate timed sequence and interlocked in such a manner that the entire process operates with a minimum of supervision and maintenance. In these instances, means were provided for switching from automatic to manual control.

Power and static groundings were combined into one grounding system wherever practicable, using copperweld cable for power ground connections and galvanized steel cable for static grounding. It was found unnecessary to install grounding jumpers on the process piping except at points where mechanical joints prevented proper connection. By means of field tests after erection, any defects in the grounding connections were found and corrected.

The lighting system was designed in combination of regular, emergency and blackout arrangement using one conduit with every third lighting fixture equipped either for emergency lighting or blackout lighting, depending on the location of the plant with respect to blackout regulations. By means of this system, lighting units can be used for any one of three requirements, necessitating only one panel board for emergency and blackout service. A separate feeder for the emergency lighting panelboard and future automatic throwover to an emergency source was installed, notwithstanding the fact that no emergency source of current was permitted. This arrangement provides for the future installation of an emergency power supply without requiring alterations in equipment. Blackout lighting was accomplished by reducing the bus voltage at the emergency distribution panelboard to 25 volts by means of auto-transformers with taps at 20 and 30 volts. This reduced voltage, applied to a 200-watt lamp, produces a light intensity equivalent to starlight on a clear night. Dome reflectors were used on these particular lights, with the filaments obscured from any point above 10° below horizontal, with reflectors in

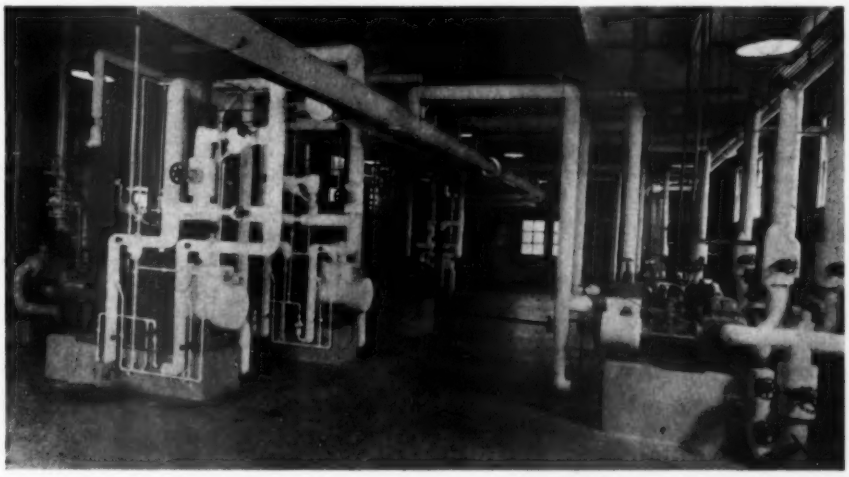
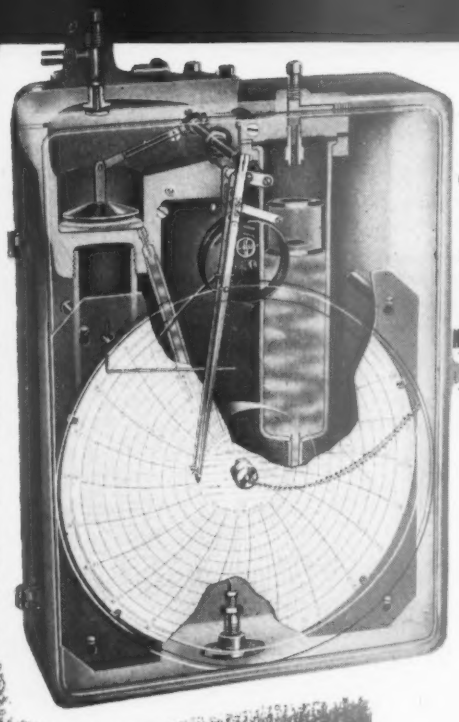


Fig. 7—Interior of typical transfer pump house

AMERICAN meters fit the most



SIMPLICITY OF DESIGN and proven reliability of operation dictated the choice of AMERICAN flow meters for this foremost aviation gasoline plant. They are our standard orifice meters, remote pressure recorders and flow controllers.

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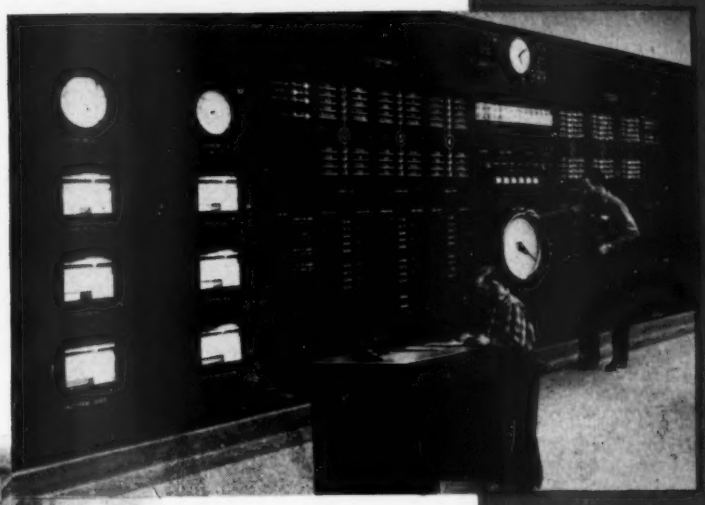
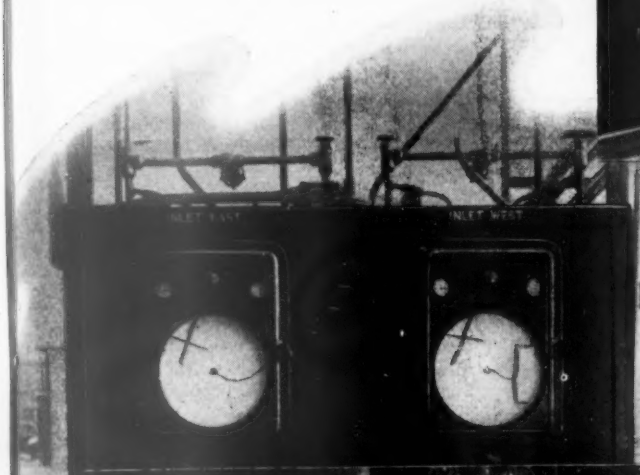
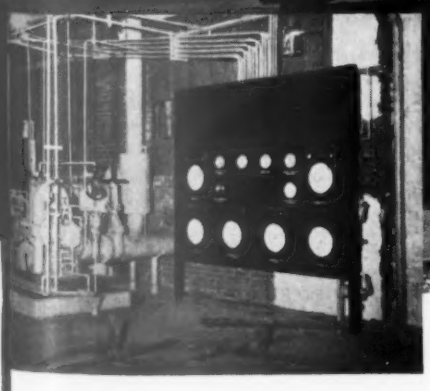
Main control board of Houdry unit at Sun Oil Company's aviation gasoline refinery, Marcus Hook, Pennsylvania. At the upper left are the **AMERICAN** *air-actuated remote pressure recorders. Instruments of this type have enabled refinery designers to have many important records grouped together on a centrally located panel board. This principle of operation eliminates long lead lines between the orifice locations and the instrument board.* **AMERICAN** *was one of the first to design this type of instrument.*





AMERICAN *inlet flow controls on charge to reboiler at the alkylation unit.*

These **AMERICAN** *flow meters are measuring products from the Houdry unit.*



On the control board at the boiler plant, another group of **AMERICAN** *flow meters.*

Fig. 8—Complete 30,000-ton recovery pump room with rotary compressors

all cases hanging directly downward. Incandescent lighting was used throughout, employing prismatic lighting units in the non-hazardous areas and regular explosion proof units in the hazardous areas.

Mechanical Equipment

The pumping facilities provided for the plant included a wide variety of types of pumps. Hydrocarbons are handled in close clearance simplex pumps. Both motor and steam drives are used for these pumps. Vapor locking of butadiene pumps and suction lines due to the high vapor pressure of butadiene at ordinary temperatures is avoided by maintaining a sufficient static pressure at the pump suction. This is accomplished by elevating the butadiene storage tanks. These pumps might have been located below grade, but this arrangement would require a ventilation system since butadiene vapor is heavier than air. The use of close clearance pumps also reduces trouble with vapor locking. An inside view of a typical transfer pump house is shown in Fig. 7.

Where relative high discharge pressures are required in handling small volumes of fluid, rotary pumps were used successfully.

For compressing the hydrocarbon vapors obtained from the recovery of the unreacted material in the latex, rotary compressors were used instead of reciprocating type units. This design materially reduced the floor space required. A 30,000-ton recovery pump room complete with these compressors in the foreground is shown in Fig. 8.

Diaphragm pumps with automatic speed control are used to pump the latex to and from the styrene stripping columns. However, for feeding the stripped latex to the coagulating system, proportioning pumps supply a constant flow, adjustable to suit conditions. Rotary vacuum filters are used to filter the coagulated latex. Filter vacuum pumps are rotary type and filtrate pumps are centrifugal type, all motor driven.

Due to the differences in first cost and operating expense of mechanical equipment for any particular service, special emphasis was placed on financial analysis of equipment proposals.

Figs. 9 and 10 indicate the financial advantages that can result from the selection of equipment on an economical basis. With total capitalized cost plotted against hours of operation per year, immediate comparison is made possible.

The first cost is represented by the curves at 0 hours per year, whereas the maximum total cost is indicated at 8760 hours or a full year. It is evident that first cost has an insignificant effect on the total cost of the equipment shown on these curves. For example, cooling tower C, Fig. 9, costs approximately 6% more than tower B, but at approximately 2250 hours operation per year these towers have equal financial worth, whereas for continuous operation Tower C is a financially better investment than Tower B, by 18% of the original cost of Tower C. This saving in power and maintenance costs is passed only to the purchaser and only by careful analysis is this desirable feature revealed.

Should the financial life of these towers be extended to 20 years, it is found that Tower A would by necessity sell for only 3% of the quoted price to have the same financial worth for rendering identical service.

In Fig. 10, a similar comparison is made for three-stage vacuum jets. As in the previous example, ejector C costs approximately 18.5% more than ejector A but for the period of comparison, the saving resulting by using ejector C would amount to 175% of the first cost. Ejector C could likewise cost 3.5 times the original selling price and still be equal to ejector A in financial worth.

The foregoing is an example of the consideration that was given to the selection of mechanical equipment for the rubber program. It was not possible in all cases to buy the most economical equipment because time of delivery and governmental regulations had to be considered.

Instruments

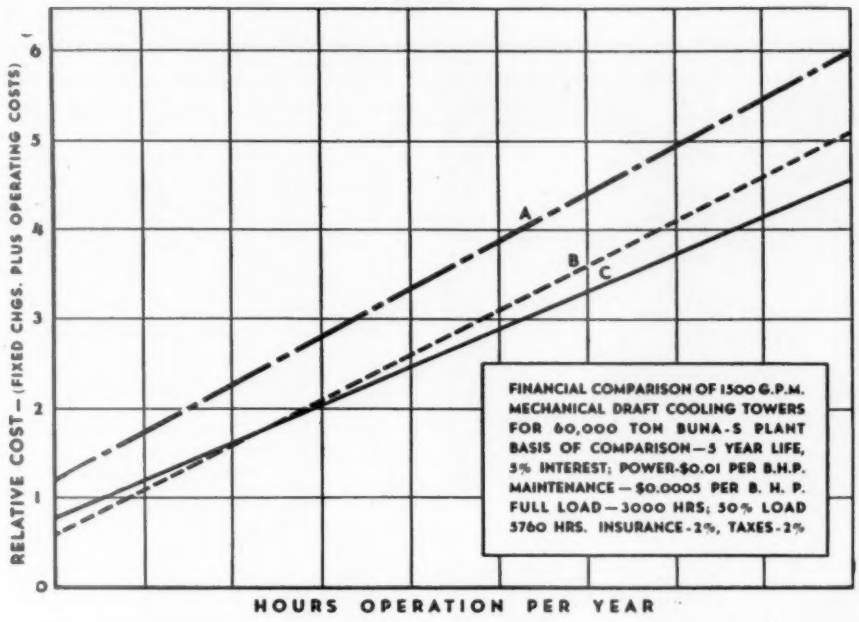
As a result of stringent limitation orders and increased wartime demands on the instrument manufacturers, as well as the urgency of the rubber program, very little development was carried out for special instrument applications in the standard GR-S plants. Notwithstanding the fact that unusual applications were encountered, the type of control and specifications for material were selected with the objective of adhering to the standard equipment available, as the time required for delivery and erection was paramount.

A very unusual installation is the meter room equipment that is located in the reactor building. This equipment measures the materials charged into the reactors and was selected on the basis of obtaining maximum accuracy in measurement. Since a substantial portion of the material passing through the meters is highly volatile and of an explosive nature, a forced draft ventilating system was installed assuring at least 20 air changes an hour in the meter room. Moreover, additional explosion protection was provided for this room by means of glass block windows for the purpose of explosion relief. All electrically controlled equipment is explosion-proof with the exception of certain meters that are purged with compressed air.

For each 15,000-ton line of reactors, a complete set of charging equipment is employed. Primary and recycle butadiene and styrene, soap solution and treated water are metered with Bassler meters equipped with automatic shut-off. A print ticket arrangement provides a record of each charge. Each set of meters is provided with a meter calibration tank and pump which will permit the continual checking of the accuracy of the meters. Catalyst and modifier solutions are weighed out, using tanks and weigh scales with automatically controlled pumps.

Control of temperature during reaction is essential for the production of uniform co-polymer. Each reactor is equipped with a steel jacket through which water is circulated. During the reaction the exothermic heat released is absorbed by the circulating water, which in this case acts as a cooling medium. During heating up of the batch to reaction temperature, the circulating water is heated with steam and serves as a heating medium. By means of water injectors, agitation of the water around the shell of the reactor is maintained. As a precautionary measure, stainless steel cooling coils are installed within the upper portion of the reactor using refrigerated water as a cooling medium. A temperature controller is provided for each reactor, the sensitive element located inside the reactor. With an increase in batch temperature the controllers admit cooling water into the jacket

Figure 9


RELATIVE COST — (FIXED CHGS. PLUS OPERATING COSTS)
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FINANCIAL COMPARISON OF 1500 G.P.M. MECHANICAL DRAFT COOLING TOWERS FOR 60,000 TON BUNA-S PLANT BASIS OF COMPARISON—5 YEAR LIFE, 5% INTEREST; POWER-$0.01 PER B.H.P. MAINTENANCE—$0.0005 PER B. H. P. FULL LOAD—3000 HRS; 50% LOAD 5760 HRS. INSURANCE-2%, TAXES-2%
HOURS OPERATION PER YEAR

circulating water pump suction, and under conditions resulting in excessive batch temperatures, refrigerated water is automatically admitted to the cooling coils referred to above. During the heating period, the controller admits steam to the circulating system.

A manual-automatic by-pass valve was incorporated into the temperature controllers so that in the automatic position the control operates the valve, but in the manual position the instrument air supply passes directly to the valves through a small pressure regulator inside the instrument. It is therefore possible, when this by-pass valve is in the manual position, to have the steam, cooling water and refrigerated water valves in the closed position. Hence, after charging the reactor, the operator can switch the control to automatic and when the reaction is completed close all control valves.

In the case of the reactors, as well as the blow-down tanks and flash tanks, the question of proper pressure protection of the vessels must be considered. Since these vessels contain hydrocarbon vapors at an elevated temperature and also foaming and splashing latex there is the possibility of material accumulating in the relief valve which would cause it to stick and interfere with its action. This problem was solved by placing a rupture disc under the relief valve thereby excluding any gum forming material from the valve. For butadiene storage tanks relief valves without the rupture discs were used and the styrene storage tanks had combination pressure and vacuum relief valves.

For maintaining a back pressure on the latex as it entered the stripping column, a special back pressure valve body was developed. To eliminate the restricting effect of the conventional globe valve body, an angle body was built up after the pattern of a standard flanged elbow, having a seat ring insert with a standard spring loaded valve topwork mounted in an opposed position. The valve stem passed through a stuffing-box at right angles to the body outlet flange. This arrangement provided good regulation with a minimum pressure drop in the valve body itself.

Recording flow controllers were used for butadiene and styrene transferred from the storage and purification areas to the reactor area. In one case where it was desired to maintain a constant fluid flow without indication or record, an orifice plate was combined with a standard differential pressure regulator placed downstream from the orifice. The regulator maintains a reasonably constant differential across the orifice thus assuring a constant flow.

Explosion proof instruments were obtained wherever possible and where suited to the requirements. Where it was not possible to obtain a suitable explosion-proof instrument for use in a hazardous area the instrument case is purged with instrument air. Panel boards are of standard design for the entire program. This arrangement permitted fabrication of these boards from one set of dies resulting in a substantial reduction in cost.

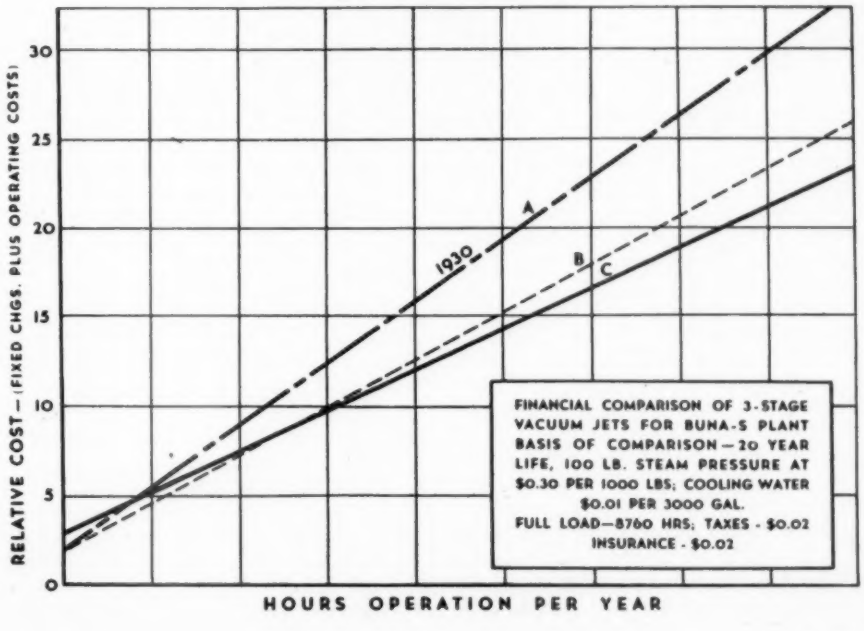
The instrument air system consists of a compressor, aftercooler, filter and dryer. Drying of instrument air results in economies in the maintenance of the instruments and eliminates difficulties due to corrosion and scale.

Fabrication

Even with a wartime demand for manpower and materials, the completed plants were equivalent to peacetime design and construction. This is evidenced by the fact that the latest safety measures were incorporated on mechanical, electrical, and structural installations. Further, this vast quantity of process equipment was constructed in strict accordance with Sect. 8 of the latest A.S.M.E. Boiler Construction Code. Likewise, where similar demands warranted its use, an A.S.M.E. qualified welding procedure and operator test were resorted to as outlined in Sect. 9 of the same code, as well as the latest A.S.A. Piping Code for the field fabrication and erection of process piping.

The all important end result has been achieved, in that these plants now are producing synthetic rubber in quantities exceeding the nation's pre-war consumption of the crude product.

Figure 10


RELATIVE COST — (FIXED CHGS. PLUS OPERATING COSTS)
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FINANCIAL COMPARISON OF 3-STAGE VACUUM JETS FOR BUNA-S PLANT BASIS OF COMPARISON—20 YEAR LIFE, 100 LB. STEAM PRESSURE AT $0.30 PER 1000 LBS; COOLING WATER $0.01 PER 3000 GAL. FULL LOAD—8760 HRS; TAXES - $0.02 INSURANCE - $0.02
HOURS OPERATION PER YEAR

Key Technologists in New Wartime Plants

J. B. Wyman

H. D. Loeb

R. L. Davis

M. R. Sprinkle

L. R. Gray

F. C. Cutting

Shell Oil Co.'s Wood River Refinery

WITH the completion of twin Fluid Catalytic Cracking units of around 30,000 barrels a day combined capacity, the wartime expansion of the Wood River refinery of Shell Oil Co. Inc. to produce aviation gasoline is virtually completed. Its output of this wartime petroleum product is around 15,000 barrels a day. Ten years ago, when the first shipment of 100-octane gasoline was made to the U. S. Army from the Wood River plant, production was only a few hundred barrels a day.

Key technologists who have had an essential part in the designing and operation of the present aviation gasoline manufacturing facilities are J. B. Wyman, H. D. Loeb, R. L. Davis, M. R. Sprinkle, L. R. Gray and F. C. Cutting. R. O. Roberts, manager of the refinery, was one of the original staff of the refinery when it was started in 1917.

J. B. Wyman is assistant superintendent in charge of cracking. His present duties include the supervision of thermal coking and reforming units and, in addition, the two new fluid catalytic units which were placed in operation early this year. Born in St. Louis, Mr. Wyman graduated in chemical engineering in 1928 from Washington University and joined the Shell organization in the same year. With the exception of one year in the experimental laboratory he has been associated with cracking and related operations at Wood River ever since.

H. D. Loeb, head of the cracking department, is now engaged in operation of the two large fluid catalyst cracking plants, having played an important part in their construction. Born in Denver, Mr. Loeb is a graduate of the University of Denver and holds an M.S. degree from Columbia in chemical engineering. He started work with Shell in 1934 at Wood River as senior technologist, moved to the head offices in New York in 1940, and was transferred back to Wood River in 1942 in his present capacity.

R. L. Davis is head of the alkylation department, which now comprises two large alkylation plants, a cumene plant, a hydrocodimer plant, and an acid treater for catalytic cracked aviation base stock. In addition, there is under consideration a hydrogenation unit for catalytic cracked base stock and a butane-isomerization plant.

Mr. Davis is from Fayetteville, Ark., graduated in chemical engineering at Louisiana State University in 1932, and was employed by Shell in that same year at the Norco, La., refinery, where he worked through various divisions of the refinery laboratory. In 1940 he was transferred to Wood River and assumed his present duties in 1943.

M. R. Sprinkle is head of the gas department, which operations comprise light hydrocarbon recovery, fractionation and treating and the manufacture of toluene. Mr. Sprinkle, born in Rusk, N. C., holds M.A. degree in chemistry from Wake Forest College and a Ph. D. in the same field from the University of Wisconsin. He entered service with Shell at Wood River in 1933 as gauger and has successively worked in the experimental laboratory, technological, treating, and gas departments, becoming head of the latter in 1943.

L. R. Gray has been chief technologist at Wood River since 1933. He has been associated with the program of modernization there, involving extensive rebuilding and modernization of topping and cracking plants, new lubricating plants, several additions and enlargements of gas plants, including hydrocodimer and alkylation plants, cumene and toluene.

Mr. Gray graduated from the University of Chicago with a B.S. degree in 1923, and in 1925 began work for Shell as assistant chief chemist of its Arkansas City, Kans. refinery. He successively was made chief chemist, chief technologist, transferring to Houston and then Wood River.

F. C. Cutting is the new superintendent exercising general supervision over the entire refinery. He succeeds H. D. Dale who was transferred to New York as manager of operations in the manufacturing department as of May 1.

Mr. Cutting was born in Troy, Mich., and received his degree of M.S. in Chemical Engineering from the University of Michigan in 1924. After an eventful period in the service of a wood products company in northern Montana, he joined the Natural Gasoline Division of the Roxana (Shell) Petroleum Corp. in 1925. His work was concerned principally with the design and operation of stabilizers and with the chemical phases of gasoline recovery operations. Since that time he has been engaged in various phases of technical work at Shell Refineries at Norco, Houston, East Chicago, and Wood River, as well as at the company's head office and with Shell Development Co. Until May 1 he held the position of Assistant Superintendent at Wood River.

This is the 6TH in a series of messages

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Economic Design of Pressure Vessels

(Article 2—Shape of Heads)

The economical design of a pressure vessel necessitates selecting the proper type of head—Ellipsoidal, or Flanged and Dished. Either of them, properly designed, will be satisfactory in most cases for meeting operating conditions. But one or the other will usually be more desirable from the cost angle, depending upon pressure, temperature, size, and like conditions.

In this article, the second of a series, Mr. Brummerstedt develops methods for computing the comparative costs of the two types of heads, working out examples of both. He then proceeds to point out general conditions under which one type of head or the other would be more efficient.

This and other articles of the series are intended to provide refiners and design engineers with fundamental data required for selecting tanks of economical design. It is not intended to favor any particular design, as it is recognized that varying conditions require different solutions.

*By E. F. Brummerstedt**

HAVING decided on the length and diameter of a pressure vessel of a given capacity and design pressure, the next question arising is the economic design of the heads.

Practically all necessary data on heads is contained in Lukens Flanging and Pressing Catalog [1], with which all pressure vessel estimators and designers are familiar.

Ellipsoidal Heads

The most common type of head for cylindrical pressure vessels is the 2:1 ellipsoidal head, covered on pp. 40-51 in Lukens' catalog. The weights they show for the heads are theoretical and on the basis of a 3 in. straight flange, which is standard up to 2 in. thickness. To obtain the probable weight to be paid for, the estimator must add to these theoretical weights the manufacturer's allowable weight overage (usually 5% for shell plates, but depending on the blank diameter of the head). It is also to be noted that the gauge or thickness actually used is usually ⅛ in. more than the minimum thickness specified by the designer. This allowance of ⅛ in. for heads up to 2 in. thick is required for thinning of the heads during the forming process and for necessary machining. Thicker heads require a greater allowance.

This article is the second of a series dealing with analytical methods for determining the economic design pressure vessels. The first of the series, "Factors Affecting Cost of Tanks," appeared last month, *NPN Technical Section, May* 3, *p. R.*-282. "Economics of Materials and Construction Factors" will be the subject of the third article, next month.

These heads can be obtained in one piece up to 156 in. I.D. and in thickness from ¾ to 2¾ in. Larger ellipsoidal heads must be formed from two or more flat plates welded together.

Example of Cost Computation

The first step in determining the cost for an ellipsoidal head of given diameter is to calculate the necessary metal thickness which will be required to meet operating conditions. This can be figured from the following formula[2]:

$$t=\frac{pD_mV}{2sE}+c \qquad \text{.....(1)}$$

where t = thickness in inches,
p = maximum allowable working pressure in psi,
D_m = mean diameter of head flange in inches, before corrosion allowance is added,
V = factor for ratio of major to minor axis of elliptical head, as given in A.P.I.-A.S.M.E. Code, p. 18,
s = maximum allowable working stress corresponding to operating temperature, in psi,
E = efficiency of any joint in the head,
c = allowance for corrosion in inches.

Assuming a case in which we want a 2:1 ellipsoidal head of A-70 firebox steel, 144 in. I.D., to resist a pressure of 250 psi at 650°F., with ⅛ in. corrosion allowance, we can solve for the thickness t using Equation 1. In this case we have the pressure p and corrosion allowance c given. The factor V for a 2:1 elliptical head as given in the A.P.I.-A.S.M.E. Code (Fig. 4, p. 18) is 1. The I.D. of our head is to be 144 in., so that we can assume the mean diameter D_m to be about 145.5 in. The maximum allowable working stress s for A-70 firebox steel at 650°F. (A.P.I.-A.S.M.E. Code, Fig. 1, p. 12) is 13,750 psi. Since this head can be obtained in one piece there is no welded joint, and hence the efficiency E is 1. Substituting in Equation 1, we then have

$$t=\frac{250\times145.5\times1}{2\times13750\times1}+.125$$

or

$$t=1.325+.125=1.45 \text{ in.}$$

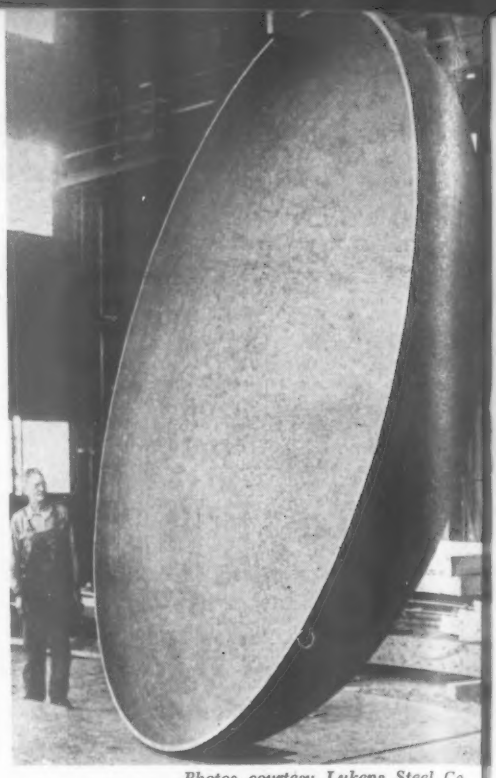
The minimum thickness of our head then should be 1½ in. To this value add ⅛ in. to allow for thinning, and we arrive at a nominal thickness of 1⅝ in.

Second step is to determine the blank diameter required. This can be figured by adding to the perimeter for the inside diameter of the head the metal thickness and twice the straight flange. In the case we're figuring, we have an I.D. of 144 in. The corresponding perimeter (Lukens' catalog, p. 41) is 177.25 in. We have previously determined the metal thickness, and since it is less than 2 in. we can use a straight flange of 3 in. Adding them all up—

Perimeter	177.25 in.
Metal thickness	1.625
Twice straight flange	6.
Total blank diameter	184.875 in.

Use a blank diameter of 185 in.

The weight of metal required for the head could be calculated from the dimensions previously figured. Lukens' catalog, however, gives the theoretical



Photos courtesy Lukens Steel Co.

Elliptical dished head. (A.P.I.—A.S.M.E. code) 14 ft., 10¾ in. I.D., ⅝ in. minimum gauge, 1⅛ in. nominal gauge, 3 in. straight flange, 48⅝ in. overall depth, spun from a flat circle 19 ft., 2 in. in diameter. Weight was 14,170 lbs. The flat circle was made by welding two plates, one 234 in. by 147 in. and the other 234 in. by 87 in., to make a 234 in. square

(1) Lukens Flanging and Pressing Catalog, No. 1, 1940, Lukens Steel Co., Coatesville, Pa.

*Petroleum Refinery Division, Foster Wheeler Corp., New York.

(2) A.P.I.-A.S.M.E. Code for Unfired Pressure Vessels, 1938, p. 17.

weight for most sizes of elliptical heads. For the case we're working with, it gives the weight (p. 47) as 12,375 lbs. To this must be added the permissible standard overweight, given as 9% in the steel handbook. Total material required is then

Theoretical weight	12,375 lbs.
9% overweight	1,115
Total material weight	13,490 lbs.

The cost of the material includes, in addition to the base cost of the metal itself, an extra for the 185 in. width and another extra for quality. Then an additional 30% should be added as a circular plate extra.

Base cost	$2.10/cwt
Width extra (185 in.)	1.50
Quality	.30
Net cost	$3.90/cwt
30% circular plate extra	1.30
Total cost, F.O.B. mill	$5.20/cwt
Freight to shop (assumed)	.20
Total cost, delivered to shop	$5.40/cwt

On this basis the material cost for our head, 13,490 lbs. or 134.9 cwt, figures out at $728.46.

Material cost, however, is only part of the total cost for the head. To it we must add the cost of flame cutting the blank, since circular plates over 1¼ in. thick cannot be sheared. This cost is figured at $.25 per foot of circumference. For our plate of 185 in. blank diameter, the flame cutting charge comes to $12.

List prices for forming heads are given in Lukens' catalog. For a 2:1 ellipsoidal head, 144 in. I.D. and 1⅝ in. gauge, the price is $232.00 (p. 47). Since we will need only two heads, a quantity increment of 10% must be added to this list price (p. 130), making the total forming cost $255.20 per head.

To machine the flanged edge will cost an additional $35.50 (style D, pp. 88-89, Lukens' catalog).

The total cost of our head then adds up as follows:

Material	$728.46
Flame cutting	12.00
Forming, list price plus 10%	255.20
Machining, style D	35.50
Total cost per head	$1031.16

Code Flanged and Dished Heads

The other type of head frequently used for pressure vessels, especially at low pressures, is the flanged and dished head with the inside corner radius at least 6% of the diameter, in accordance with the A.S.M.E. and A.P.I.-A.S.M.E. Codes. It can be obtained in one piece up to 180 in. O.D., for thicknesses of ½ in. and ⅝ in.

The tables in Lukens' catalog (pp. 28-39) are based on these heads being formed to the O.D., rather than I.D. as is customary for ellipsoidal heads and vessel design in general.

In the following example the cost of a 144 in. I.D. flanged and dished head will be calculated in comparison with the cost of the 144 in. I.D. 2:1 ellipsoidal head previously computed.

As with the ellipsoidal head, the first step in determining cost is to calculate the necessary metal thickness. This thickness can be figured using the following formula[2]:

$$t=\frac{pR_cW}{2sE}+c \qquad \text{.....(2)}$$

where t, p, s, E and c represent the same factors as in Equation 1, and

R_c = mean radius of the crown plate in inches,

W = factor for ratio of mean knuckle radius to mean crown radius, as given in A.P.I.-A.S.M.E. Code, p. 19.

As in the first example, p is 250 psi, s is 13,750 psi, E is 1, and c is .125 in. The mean crown radius R_c is calculated by adding half the assumed plate thickness of 2½ in., or 1¼ in., to the radius of dish, given as 132 in. in Lukens' catalog (p. 39), making R_c equal to 133.25 in. The mean knuckle radius is obtained similarly by adding 1¼ in. to the inside corner radius of 8¾ in. (p. 39), making it 10 in. Factor W for the ratio of the mean knuckle radius to the crown radius (10/133.25) is approximately 1.67, taken from the table on p. 19 of the A.P.I.-A.S.M.E. Code. Substituting in Equation 2, we then have

$$t=\frac{250\times133.25\times1.67}{2\times13750\times1}+1.25$$

or

$$t=2.02+.125=2.145 \text{ in.}$$

Use a minimum thickness of $2\frac{1}{16}$ in. Since the minimum thickness is over 2 in., ¼ in. must be added for thinning allowance, so that the nominal metal thickness will be $2\frac{1}{16}$ in.

Since the tables in Lukens' catalog (pp. 32-39) give the blank diameters based on O.D. and with only a 1½ in. straight flange, it is preferable to calculate the blank diameter directly in accordance with the following formula:

$$D_b=D+\frac{D}{24}+2SF+\frac{2r}{3}+t \qquad \text{.....(3)}$$

where D_b = blank diameter in inches,

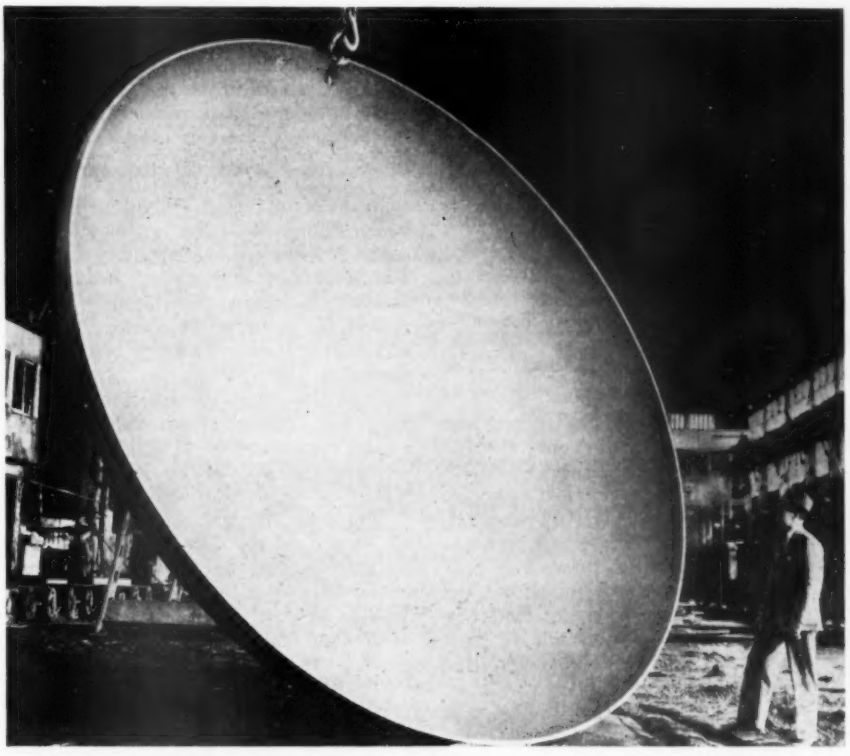
D = outside diameter of head in inches,

SF = straight flange in inches,

r = inside corner radius in inches,

t = thickness of head plate in inches.

The outside diameter D can be obtained by adding twice the minimum metal thickness ($2\frac{1}{16}$ in.) to the given



Flanged and dished head (A.P.I.—A.S.M.E. code), 18 ft. O.D., one of the largest heads ever spun in one piece; for use in a fractionating tower. It had a nominal gauge of 1-1/16 in. and minimum gauge of ⅞ in., with 170 in. radius of dish, 13 in. inside corner radius, 3⅛ in. straight flange, 48⅜ in. overall depth. Weight was 15,700 lbs. A flat circle 249 in. in diameter was required, obtained by welding two plates 251 in. by 125½ in. into a plate 251 in. square, from which the blank was cut

inside diameter of the head (144 in.), thus:

Inside diameter	144. in.
Twice min. metal thickness	4.375
Outside diameter D	148.375 in.

Our straight flange SF will be 3 in., our inside corner radius r has previously been obtained as 8.75 in., and thickness t is $2\frac{1}{16}$. Substituting these values in Equation 3

$$D_b = 148.375 + \frac{148.375}{24} + 2(3) + \frac{2(8.75)}{3} + 2.4375$$

or

$$D_b = 168.8275$$

Use a blank diameter of 169 in.

The weight of a circular steel plate of 169 in. in diameter and 1 in. thick is 6356 lbs (Lukens' catalog, p. 94). The material we'll require for our head, $2\frac{1}{16}$ in. thick, will therefore be approximately 15,500 lbs. To this figure must be added a 7% overweight tolerance, so that our total material weight then becomes

Blank weight	15,500 lbs
7% overweight	1,085
Total material weight	16,585 lbs

Our material cost, as with the 2:1 ellipsoidal head, will include extras, as follows:

Base cost	$2.10/cwt
Width extra (169 in.)	1.25
Quality	.30
Heavy gauge extra (over 2 in.)	.60
Normalizing extra (over 2 in.)	.50
Net cost	$4.75/cwt
30% circular plate extra	1.58
Total cost, F.O.B. mill	$6.33/cwt
Freight to shop (assumed)	.20

Total cost, delivered to shop $6.53/cwt

The material cost for the flanged and dished head then figures out, for the 16,585 lbs or 165.85 cwt, to be $1083.00.

But as with the previous example, material cost is only part of the total. Flame cutting of the circular blank, too thick to be sheared, is figured at $.37 per foot of circumference, more than for the ellipsoidal head because of the extra thickness ($2\frac{1}{16}$ in. instead of $1\frac{1}{2}$ in.). For our plate of 169 in. diameter, this charge amounts to $16.25.

The list price for forming the head is given as $215.00 (Lukens' catalog, p. 39). As before, a quantity increment of 10% must be added to this list price, making the total forming cost $236.50.

To machine the flanged edge will cost another $52.00 (style D, pp. 88-89, Lukens' catalog).

Adding them all up, the total cost of the head then amounts to:

Material	$1083.00
Flame cutting	16.25
Forming, list price plus 10%	236.50
Machining, style D	52.00
Total cost per head	$1387.75

Comparing the two figures, $1031.16 for the 2:1 ellipsoidal head and $1387.75 for the flanged and dished head, we find the former far less expensive in this case. The difference is due primarily to the excessive thickness of the dished head, and the gauge and normalizing extras involved in thicknesses over 2 in.

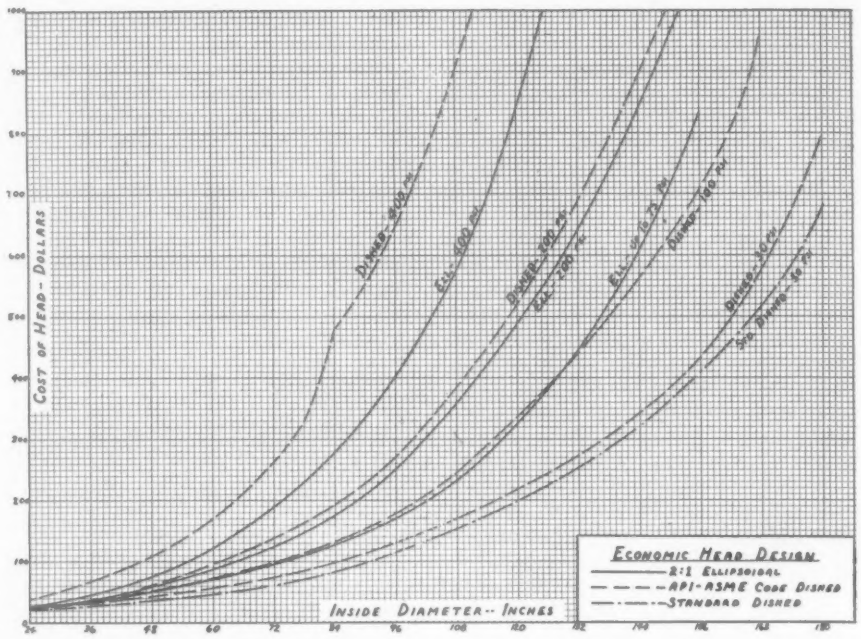


Fig. B—Comparison of cost factor for various head designs at several pressures

Generalized Comparisons

In order to find the dividing line between those pressures for which ellipsoidal heads were cheaper, and those for which flanged and dished heads were cheaper, the above calculations were repeated for a sufficient number of sizes at various pressure to result in the chart shown in Figure B.

From this chart the following conclusions are obvious:

1. At a pressure of 200 psi ellipsoidal heads begin to be cheaper than dished heads, the difference increasing with the pressure.
2. At 400 psi the difference is considerable, averaging approximately 50% of the cost of the ellipsoidal head.
3. The lightest ellipsoidal head is heavier and considerably more expensive than the lightest dished head, due to differences in fabricating procedures. Spinning ellipsoidal heads requires greater minimum thickness than pressing dished heads on a die.
4. The lightest ellipsoidal head is capable of withstanding a pressure of approximately 75 psi. Its cost is about equal to that of a dished head designed for 100 psi, except the latter is cheaper in large diameters. Hence the dished head should always be used for pressures around 100 psi or less.
5. The dividing line appears to be in the neighborhood of 150—175 psi. In this range choice of heads is immaterial from a cost standpoint, and should be governed by considerations of availability, delivery, consistency, etc.
6. The cheapest head is the non-code standard flanged and dished, which can profitably be used for low-pressure tanks not of code design or construction. Its cost can be computed similarly to the method indicated for a code flanged and dished head. Its lower cost is due primarily to its small corner radius and shallow depth of dish.

For vessels too large in diameter for one-piece heads, built-up hemispherical heads are usually cheapest, if facilities are available for forming spherical segments. Except for corrosion allowance, they need be only half as thick as built-up 2:1 ellipsoidal heads.

Conical heads are generally not very desirable for large diameter vessels unless joined to the cylindrical shell with a knuckle radius, which would make their cost higher than that of other types. For small diameter tanks, where a knuckle is not essential, and where a large manhole is to be attached at the center of the head, a conical design may be economical, since no reinforcing would be required for the manhole.

Flat flanged heads are economical only for small diameters, 3 ft or less, and low pressures, and where their use would eliminate a manhole.

The above conclusions apply to most cases in standard design, but occasionally unusual conditions arise which can only be settled by special consideration of all factors involved.

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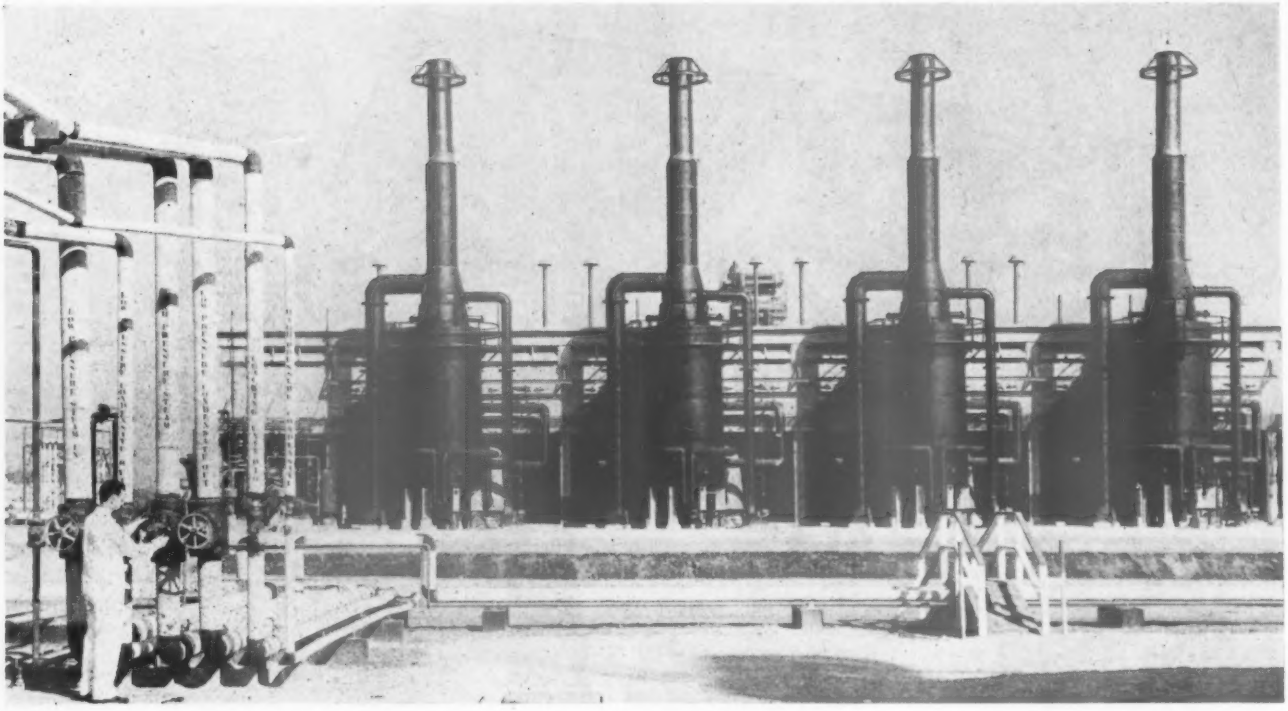

Unit for the dehydrogenation of ethylbenzene into styrene at Dow Chemical Co. Los Angeles plant of California Synthetic Rubber Project

Butadiene by Thermal Cracking of Naphtha Included in California Rubber Project

THE manufacture of butadiene by the thermal cracking of naphtha is included in the operating program of the California Synthetic Rubber Project of the government's Rubber Reserve Co. This is done at a converted plant of the Southern California Gas Co. in Los Angeles.

Oil companies in the project which produce butadiene by conventional methods are Standard Oil Co. of California and Shell Chemical Division of Shell Union Oil Corp. Styrene for the GR-S type rubber produced is made at a plant of Dow Chemical Co. Goodyear Synthetic Rubber Corp. and the United States Rubber Co. combine the raw materials into synthetic rubber in three copolymer plants. Rated capacity of the project is 90,000 tons of rubber annually, one-eighth of all the GR-S type synthetic rubber called for in the government's rubber program. An announcement issued April 24 stated the project is now completed and in full operation.

"While the six companies operate the central units, so many other Pacific Coast industries contribute raw materials to the project that its significance in production and the use of finished products made from it touches every individual on the Pacific Coast", stated the announcement. "The raw materials for making butadiene, one of the basic materials, can be secured from almost all of California's oil producers.

"Dow Chemical Co.'s styrene unit receives alcohol from the wine distillers of the Pacific Coast, benzol from Kaiser's Fontana coke ovens and from the Portland Gas and Coke Co. From Utah and California's desert areas come rock salt, 70 tons of which are used daily as a coagulating agent."

Makes Area Self-sufficient

"The completion of this project, construction of which was begun in September, 1942, places the Pacific Coast areas in a self-sufficient position so far as rubber and rubber products are concerned," it was stated. "The major rubber companies, all of which have factories in Los Angeles, together with the other Pacific Coast rubber manufacturers will consume the output of GR-S rubber in making all types of finished products, from conveyor belts to tires for use by the West Coast's expanding industries."

The process of cracking naphtha to obtain C_4 cut including a substantial proportion of butadiene with the butane and butylenes is accomplished in the Aliso Street, Los Angeles, gas works of the Southern California Gas Co. On June 26, 1942, the Defense Plant Corp. requested the company to convert this plant to the manufacture of butadiene. It had a capacity of 50 million cubic feet of gas per day derived from Diesel oil. The company made exhaustive research into the processes involved and the actual work of converting the plant started in September.

Naphtha or low-grade gasolines of special types are thermally cracked in brick-lined regenerative stoves of the type used for producing oil gas. The resulting C_4 cut is recovered by conventional gas absorption and is then sent by pipeline to the Shell Chemical Co. The other ingredients obtained as by-products are used in the manufacture of fuel gas, fuel oil and aviation gasoline. The raw materials used as feed stocks are obtained from refineries of Shell Oil Co., Tide Water Associated Oil Co., Wilshire Oil Co., Inc., The Texas Co., Union Oil Co. of California, General Petroleum Corp. and Standard Oil Co. of California, located in the Los Angeles area.

In the regenerative type of furnace the refractory lining is heated until the required high temperature is reached, then combustion is terminated and the preheated hydrocarbon feed is sprayed on the refractory. When the temperature decreases to a predetermined level, the feed is cut off and followed by the regenerative blast.

The C_4 fraction from the gas company's plant is piped to the Shell Chem-

An historic wedding

A momentous wedding occurred more than 10 years ago when an olefin was joined with a paraffin They are members of two different hydrocarbon families which chemists for years had believed to be wholly incompatible

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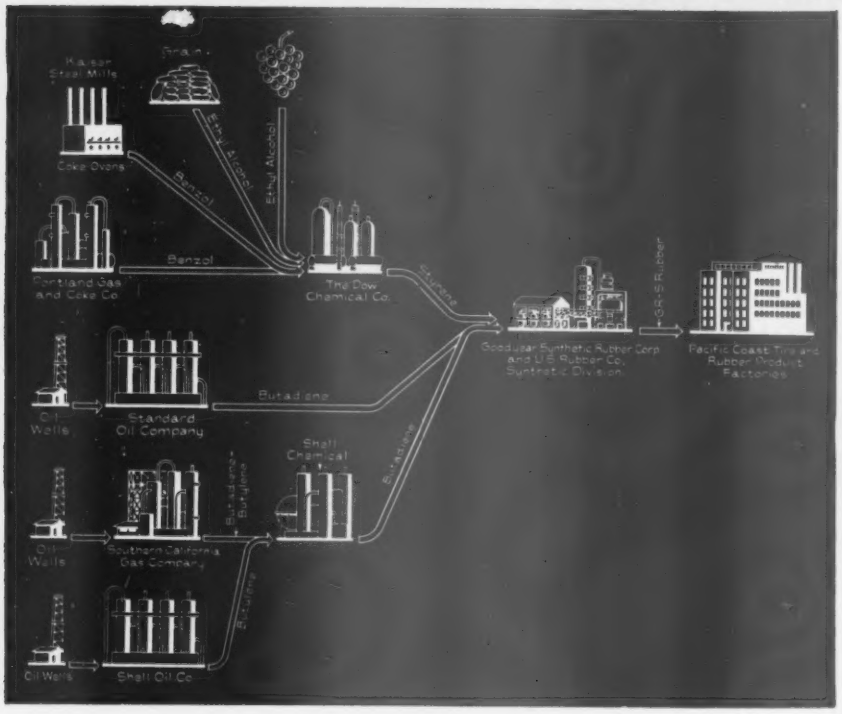
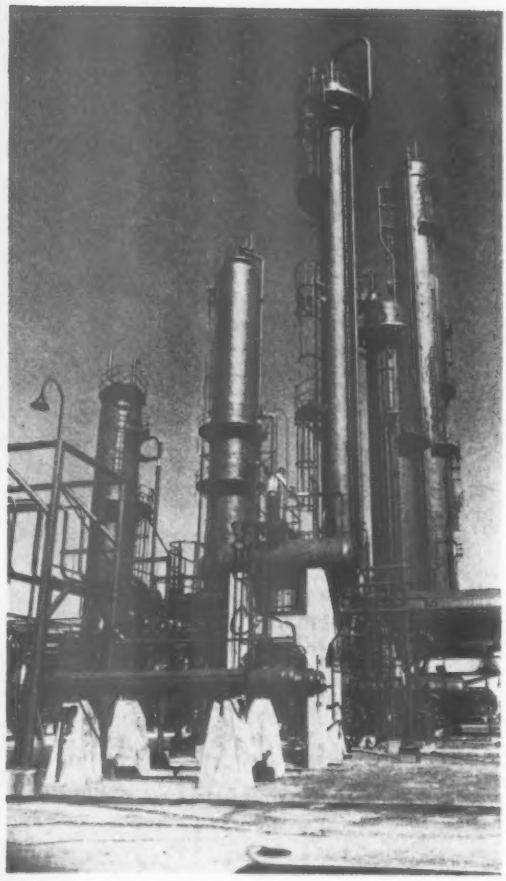
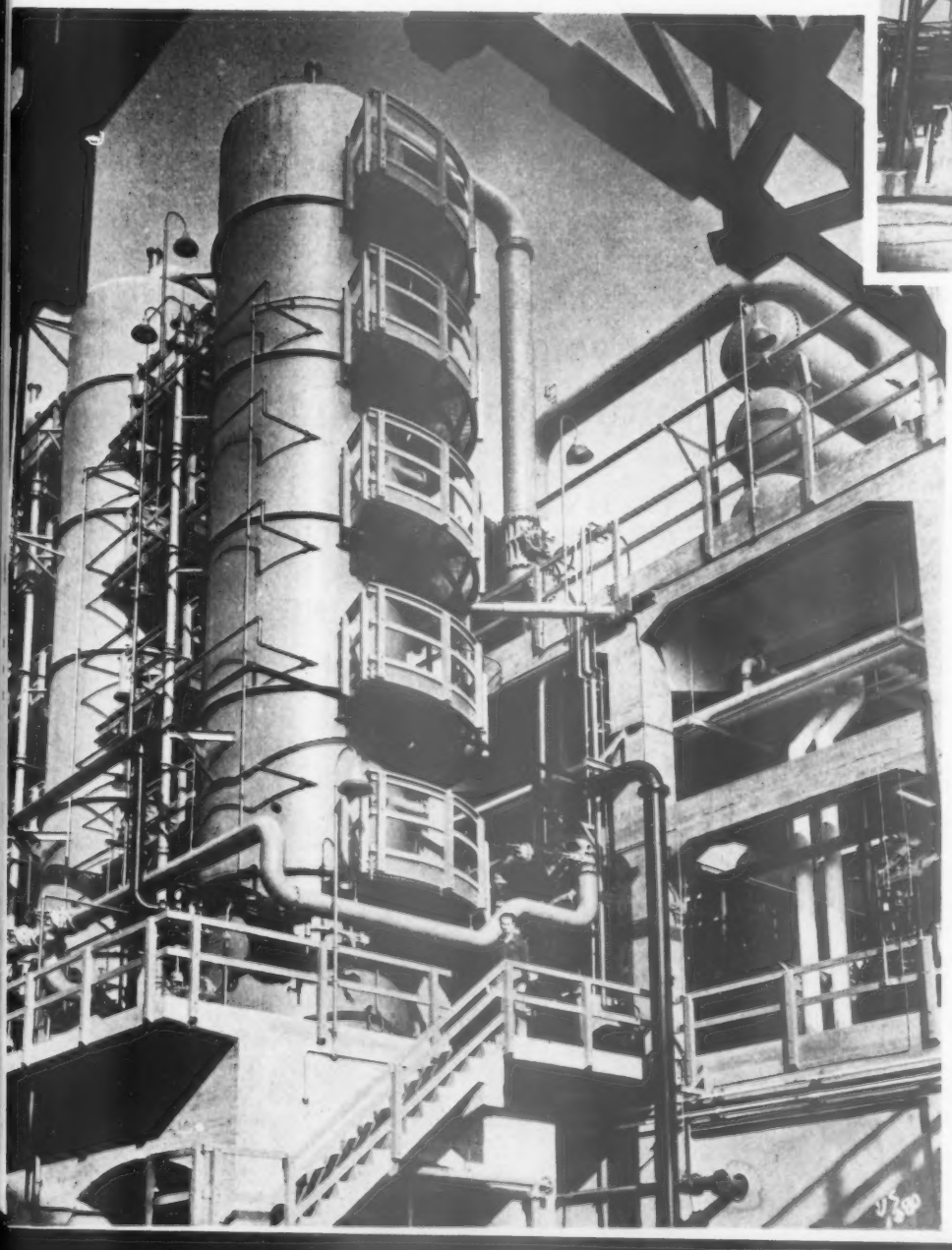


Steps in the production of GR-S in the California Synthetic Rubber Project, in which two oil companies, a gas company, chemical company and two rubber companies in the Los Angeles area are participating



Above, Acetone extraction unit in the Shell Chemical Division's plant, which separates butylenes from a mixture of hydrocarbons



Left, Styrene stripping columns, where unreacted styrene from the polymerization reaction is recovered and returned to storage in one of the three copolymer units in the California Synthetic Rubber Project. Two rubber companies operate the copolymer plant

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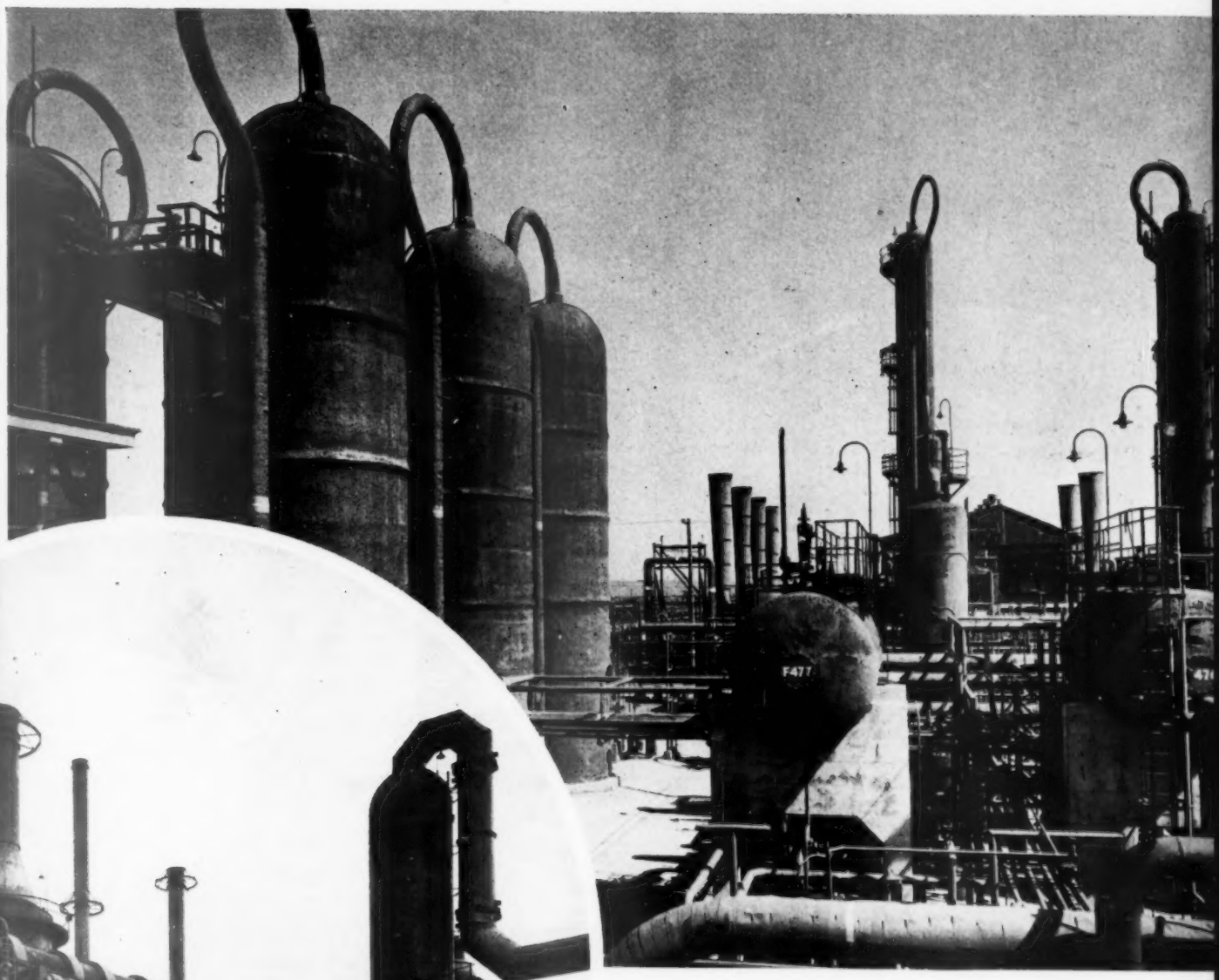
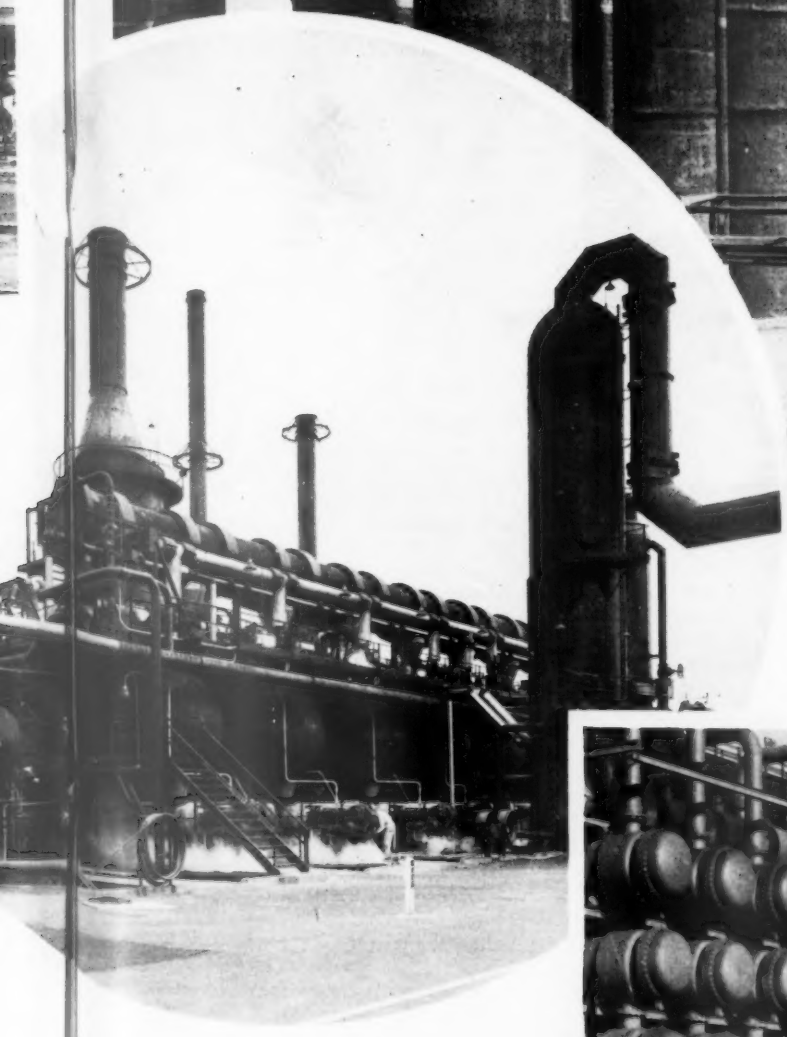
FORNIA'S SYNTHETIC RUBBER PROJECT

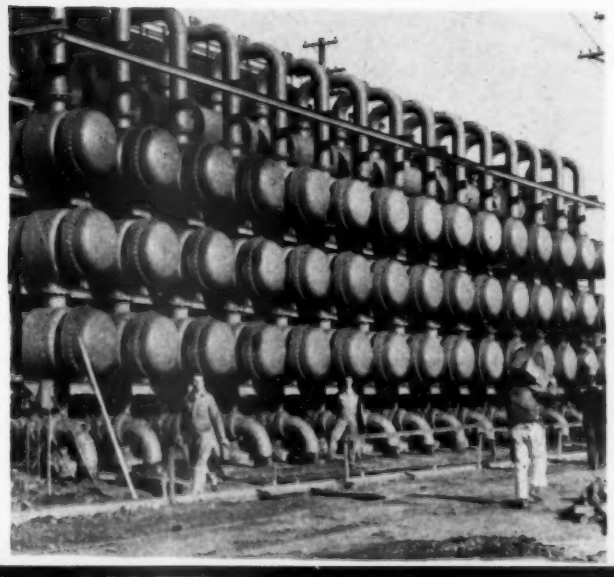
s in Los Angeles Area Contribute to Producing GR-S



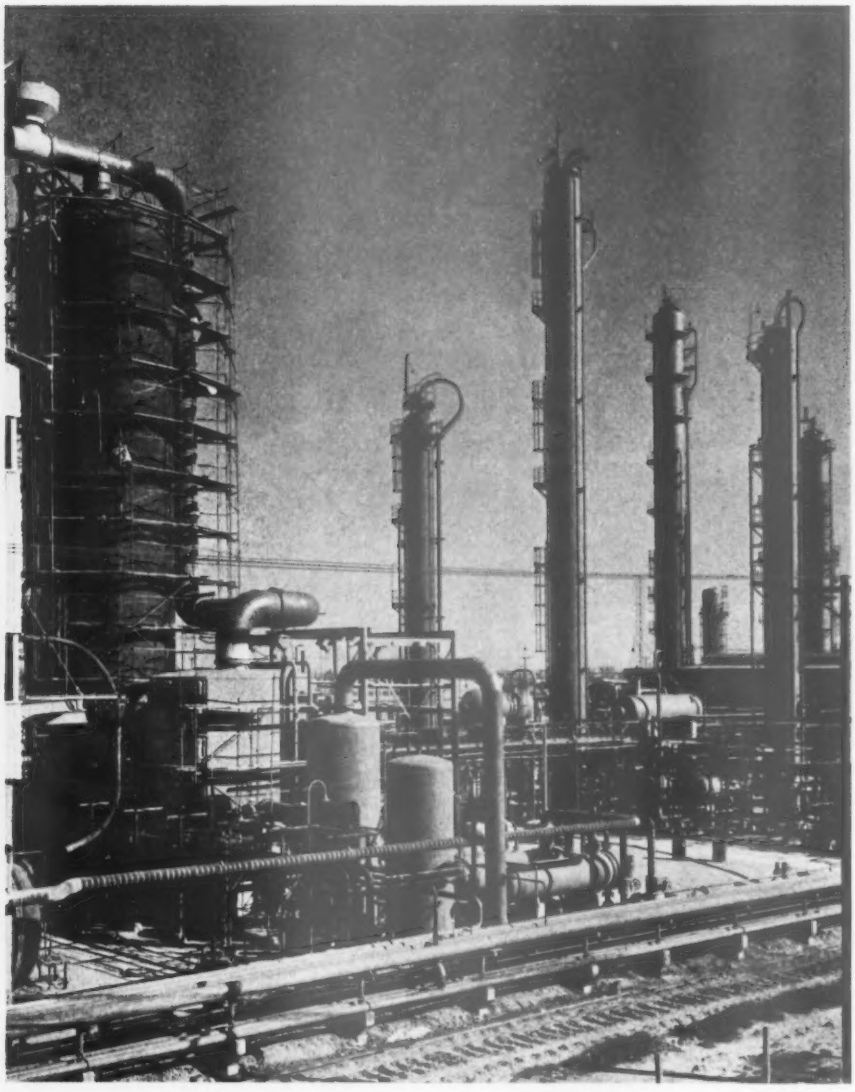
Acetylene polymerization unit in the Shell Chemical Division plant, which converts undesirable acetylenes in the hydrocarbon stream into polymers, to facilitate their removal



Above, Reactors, quench column at right and stacks of furnaces at rear, in butadiene plant of Standard Oil Co. of California in the California Synthetic Rubber Project



Left, Battery of heat exchangers at the butadiene plant of the Southern California Gas Co., in the California Synthetic Rubber Project, which cools water which in turn cools the gases from the reaction containing butadiene and other C_4 constituents



Catalytic dehydrogenation unit at the Shell Chemical Division plant which converts butylenes into butadiene

ical Division's plant, which is a part of the California Synthetic Rubber Project. Chief components of the fraction are butadiene and butylene, with a trace of acetylene resulting from the thermal cracking reaction. The hydrocarbon stream is processed in an acetylene polymerization unit which polymerizes the acetylene compounds into polymers to facilitate their removal. The butadiene-butylene mixture is fed into an acetone extraction unit which separates the butylenes from the mixture.

The remaining butylene is then combined with a butylene-butane mixture brought from one of Shell's refineries. The combined mixture of butylene and butane is processed in a cold sulfuric acid plant which extracts isobutylene from the material and converts it into di-isobutylene, which is shipped to one of the Shell company's refineries for use in manufacturing aviation gasoline. The remaining butanes and normal butylenes are sent through an extraction unit where the butanes are removed. These are also piped to a Shell refinery to become a component of aviation gasoline. The normal butylenes are converted into butadiene by catalytic dehydrogenation. This butadiene is combined with that earlier separated from the stream from the Southern California Gas Co.'s plant and purified and then shipped to the copolymer plants operated by the rubber companies. Unreacted materials from the copolymer plants are recovered and returned to the Shell Chemical plant for reprocessing.

A new butadiene plant at the El Segundo refinery of Standard Oil Co. of California is included in the California Synthetic Rubber Project. This unit which went into production in January was built for Defense Plant Corp. and is operated by the oil company for Rubber Reserve Co. Bechtel-McCone-Parsons Corp. were the contractors. Manufacture of butadiene is by conventional dehydrogenation of butenes. Surplus heat from the process is recovered in high pressure boilers, where it generates 55,000 lb. of steam hourly for operation of pumps and for process heating. The compressor installation handling the various hydrocarbon gas streams totals 7500 horsepower and is said to be the largest compressor installation in the west.

Dow Chemical Co.'s styrene plant at Los Angeles was the first unit in the California Synthetic Rubber Project to go into production. Construction started in September, 1942, and in June, 1943, the first styrene was produced. Since the California copolymer plants could not at this time use the production for many months it was shipped east.

In the Dow styrene process as earlier described, ethylene is reacted with benzene in the presence of aluminum chloride as a catalyst, at temperatures of about 190° F. and 15 lb. gauge pressure, to form ethylbenzene. The ethylbenzene vapors, mixed with highly superheated steam, are dehydrogenated into styrene.

Purified by Distillation

From the wine industry of California the company receives 15,000 gal. a day of pure alcohol which is used in the manufacture of ethylene. Fifteen thousand gal. a day of pure benzol are used, much of it coming from the Kaiser Fontana, Cal., coke ovens. The styrene is purified by distillation and is then piped to the copolymer units of the project. At present all the production of styrene goes into synthetic rubber. Dow company engineers, however, are looking to the day when part of this material can be diverted into plastics manufacture, bases for varnish and lacquer, insulating materials and other uses.

The three copolymer plants of the project, with a rated capacity of 90,000 long tons of synthetic rubber annually, are operated by Goodyear Synthetic Rubber Corp. and United States Rubber Co. Styrene and butadiene in liquid form are received from the adjacent raw materials plants. They are emulsified in a soap solution by whipping them into small droplets. The temperature of the batch is then raised and polymerization starts.

The progress of the reaction is carefully checked and, when polymerization has reached a certain point, a chemical is added to arrest further polymerization. The batch is then run off to the blowdown tanks. Here the synthetic rubber latex is tested. The hydrocarbons which have not combined are recovered. The butadiene is separated from the mixture by letting it boil off as a gas and recovered by compressing it. The styrene is recovered by distilling the mixture under reduced pressures at higher temperatures.

The latex is coagulated by salt and acid and filtered, washed and dried. It is pressed into 75-lb. bales, 9000 such bales or loaves being produced every day of full operation.

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Thermal Properties of Hydrocarbons

(Article 2 in a Series)

Improved correlations applicable to various types of hydrocarbons are developed for heat capacities in the liquid and ideal vapor states and for heats of vaporization. These correlations are based on consideration of the data recently developed from spectroscopic measurements and are made mutually consistent with one another by generalized thermodynamic methods. Enthalpies calculated from the resultant charts are in good agreement with calorimetric data on petroleum fractions.

By J. F. Fallon and K. M. Watson**

DEVELOPMENT of satisfactory correlations of the thermal properties of hydrocarbons and petroleum fractions, particularly at high temperatures, is complicated by the diverse natures of the many compounds under consideration and by the inconsistencies of the data available. The earlier correlations were restricted to single series of hydrocarbons (for the most part paraffins) or to petroleum fractions from particular types of crude.

A general correlation of specific heats applicable to all types of hydrocarbons and petroleum fractions in both the liquid and vapor states was proposed by Watson and Nelson[16] as a result of analysis and averaging of the available calorimetric data. These data for the heat capacities of the liquid state were reviewed by Gaucher[7] who concluded that the Watson and Nelson correlation was as satisfactory as was possible.

More recently much attention has been given to the development of heat capacity values for the ideal vapor state from spectroscopic data and statistical calculations. With proper frequency assignments these methods are rigorous over wide ranges of temperature. The assignment of frequencies for complex molecules is difficult, but much progress has been made for specific compounds and series. The results of this work were recently summarized by Spencer and Flannagan[12] in the form of empirical heat capacity equations based on the best frequency assignments. Values for normal paraffins up to octane were included, along with isobutane, ethylene, and acetylene.

An attempt to generalize heat capacity calculations was made by Dobratz[3] who modified the empirical correlation of frequency assignments developed by Bennewitz and Rossner[2] to yield a method for estimating the constants of an empirical heat capacity equation from the structural formula of a compound. This method gives results in excellent agreement with the data for many substances, but may lead to serious errors when applied to compounds very different in type from those on which the structural contributions were based. Errors would be expected to be greatest at high temperatures.

Watson and Nelson[16] recommended that heat of vaporization at atmospheric pressure be calculated by the Kistiakowsky equation and corrected to other temperatures by the empirical curves developed by Watson[14]. A modification of this procedure was recently proposed[15] in which the heat of vaporization is calculated from the boiling point and critical point by a combination of the Clausius-Clapeyron equation with the Calingaert-Davis vapor pressure equation. The effect of temperature on heat of vaporization is expressed by an empirical equation. In this same paper a generalized relation is developed between the heat of vaporization calculated in this manner and the difference between the heat capacities of the liquid and vapor states.

The work here reported was undertaken in an effort to develop improved correlations of vapor and liquid heat capacities and heats of vaporization, which are in agreement with the new spectroscopic data and are thermodynamically consistent with one another in accordance with the generalized relations[15] referred to above.

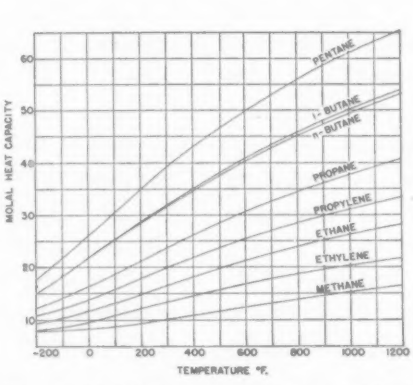

Fig. 1—Molal heat capacities of ideal light hydrocarbon gases

Heat Capacities

The recommendations of Spencer and Flannagan were accepted for the light paraffins and for ethylene above room temperature. These data are in the form of constants for the equation

$$c_p^\circ = a + bT + cT^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

The recommended constants are listed in Table I and the corresponding curves are plotted in Fig. 1.

Values for the heat capacity of propylene at temperatures up to 490° K. were determined by Telfair[13] who used an ultrasonic method yielding results believed to be in error by less than 0.6%. The difference between the molal heat capacities of propane and propylene at 189° F. was determined to be 3.07 from these data and the equation of Table I. The difference between the heat capacity of ethane and ethylene at this same temperature is 2.62. Thus the ratio of the heat capacity difference between propane and propylene to that between ethane and ethylene is 1.17. It is assumed that this ratio is independent of temperature, and the data for propylene in Table I and Fig. 1 were derived on this basis.

In the absence of data for olefins of higher molecular weight it is recommended that the difference between the heat capacity of a paraffin and that of the corresponding olefin be taken as equal to the difference between propane and propylene. The constants for an equation expressing this difference are included in Table I.

Equation 1 may be used without serious error at temperatures down to 50° F. or somewhat lower for the heavier gases. The curves for the lighter gases pass through a point of inversion and become concave upward at lower temperatures, deviating widely from Equation 1 be-

TABLE I—Heat Capacities of Light Hydrocarbon Gases

(For 50° to 1400° F.: $c_p^\circ = a + bT + cT^2$; for −300° to 200° F.: $c_p^\circ = 7.95 + uT_r^v$)

Compound	a	$b \times 10^3$	$c \times 10^6$	u	v
Methane	3.42	9.91	−1.28	6.4×10^{-12}	4.00
Ethylene	2.71	16.20	−2.80	8.13×10^{-11}	3.85
Ethane	1.38	23.25	−4.27	6.20×10^{-4}	1.79
Propylene	1.97	27.69	−5.25	2.57×10^{-3}	1.26
Propane	0.41	35.95	−6.97	3.97×10^{-3}	1.25
n-Butane	2.25	45.40	−8.83	0.93×10^{-2}	1.19
Isobutane	2.30	45.78	−8.89	0.93×10^{-2}	1.19
Pentane	3.14	55.85	−10.98	3.9×10^{-3}	1.0
(Paraffin-olefin)	−1.56	8.26	−1.72	.....	...

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cause the molal heat capacities of all complex nonlinear molecules tend to approach a constant equipartition value of 7.95 at low temperatures. This complex behavior is difficult to represent by a single equation. Accordingly, Equation 1 is recommended for the high-temperature range and the following empirical form for the low-temperature range from —300° to +200° F.:

$$c_p = 7.95 + uT^v \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

The form of Equation 2 was verified by plotting log $(c_p - 7.95)$ against log T for methane, ethane, and ethylene. Reasonably satisfactory linear relations resulted at low temperatures which corresponded to extrapolations of high-temperature data. In this manner the values of u and v in Table I were determined. There is some discontinuity between Equations 1 and 2 in the range 0-200° F., and the curves in Fig. 1 are smoothed average values.

Specific Heats of Vapor

Plotting the data of Spencer and Flannagan for the paraffins as specific heats yields a closely grouped family of curves, which indicates little change in specific heat with molecular weight above pentane. Accordingly it is assumed that the specific heats of the higher paraffins are the same as that of pentane.

These data were plotted against temperatures along with the available calorimetric data on petroleum fractions[1, 6, 17]. Similar curves for benzene and *tert*-butylbenzene were plotted by the method of Dobratz[3]. The method of Watson[15] was then used to calculate heat capacities of the vapor state from the available calorimetric data on the heat capacities of liquid petroleum fractions[4, 6, 17]. Examinations of the resultant family of curves indicated discrepancies from any conceivable correlation involving only simple correlating variables. However, by cross plotting and averaging the data at various temperatures, the correlation shown in Fig. 2 was arrived at as the best compromise possible. These curves are represented by the following equation:

$$C_p = (.0450K - .233) + (.440 + .0177K)(10^{-3}t) - .1530(10^{-6}t^2) \quad \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

where K = characterization factor of Watson and Nelson[16].

This correlation differs from that of Watson and Nelson in that only the characterization factor is used to characterize the stock. No systematic variation was found from this correlation with wide variations in gravity and boiling point. This general form of correlation was first proposed by Smith and C. C. Watson[10] and is confirmed by the present analysis and the spectroscopic data on the paraffins.

The results of Equation 3 are in good agreement with the recommendations of Spencer and Flannagan for paraffins. The values calculated by the method of Dobratz for aromatics fall considerably below the correlation at high temperatures; the calorimetric data on aromatic petroleum fractions[6] tend to lie higher than the correlation. Comparisons of calculated and observed values are shown in Table II.

Specific Heats of Liquids

Specific heats of the liquid state were calculated from the correlation expressed by Equation 3 using the generalized thermodynamic method[15]. These calculations were restricted to reduced temperatures below 0.85 where the effects of moderate pressure changes on the heat capacity of the liquid are negligible. The molecular weight correlations of Watson and Nelson[16] and the critical properties of Smith and Watson[11] were used in these calculations.

The resulting calculated specific heats of the liquid were in fair agreement with the correlation of Watson and Nelson at high temperatures but were considerably lower at low temperatures. However, in this range the generalized thermodynamic method for calculating differences between liquid and vapor heat capacities is of questionable accuracy. These values were compared with the direct data on the liquid petroleum fractions and the correlation shown in Fig. 3 was obtained. The curves for propane and butane are those recommended by Holcomb and Brown[8]. The curves for the heavier stocks are represented by the following equation:

$$C_p = [(.355 + .128\times10^{-2}\,°\text{API}) + (.503 + .117\times10^{-2}\,°\text{API})10^{-3}t]\times(.05K + .41) \quad \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Values from this correlation tend to be somewhat lower than those of Watson and Nelson but are in good agreement with the calorimetric data of Gary, Rubin, and Ward. The experimental values of Weir and Eaton tend to be higher than the correlation. Comparisons of the calculated and observed enthalpies of a few stocks are shown in Table III. It is believed that the calorimetric measurements of Gary, Rubin, and Ward are the most accurate available, and the choice of the present correlation is confirmed by its agreement with their data and its thermodynamic consistency with the correlation for the ideal vapor state.

Heats of Vaporization

The heat of vaporization at atmospheric pressure is satisfactorily expressed by the following modified form of the Clausius-Clapeyron equation:

$$\lambda = \frac{zRT^2}{p}\,\frac{dv}{dT} = \frac{zRT_r^2T_c^2}{p}\,\frac{dp}{dT}. \quad (5)$$

The derivative dp/dT may be evaluated by differentiation of the vapor pressure

TABLE II—Comparison of Calculated and Observed Heat Capacities of Hydrocarbon Vapors

Substance	Citation	° API	K	Specific Heat, $t = 400°$ F. Obsvd.	$t = 400°$ F. Calcd.	$t = 700°$ F. Obsvd.	$t = 700°$ F. Calcd.
Gas oil	(17)	34.9	12.0	0.545	0.542	0.682	0.689
Gas oil	(1)	27.3	11.53	0.521	0.520	0.662	0.662
Refractory oil	(17)	15.3	10.26	0.450	0.452	0.520	0.590
Refined oil	(17)	41	11.73	0.554	0.529	0.682	0.672
Oleum spirits	(1)	48.8	11.76	0.544	0.530	0.681	0.674
Gasoline	(1)	75	12.45	0.557	0.568	0.705	0.713
Pentane	(12)	92.7	13.04	0.588	0.597	0.737	0.748
Hexane	(12)	81.6	12.81	0.595	0.595	0.733	0.736
Octane	(12)	69.8	12.65	0.594	0.578	0.731	0.727
Benzene	(3)	29.0	9.7	0.395	0.424	0.502	0.555
tert-Butylbenzene	(3)	32.2	10.65	0.444	0.474	0.567	0.612

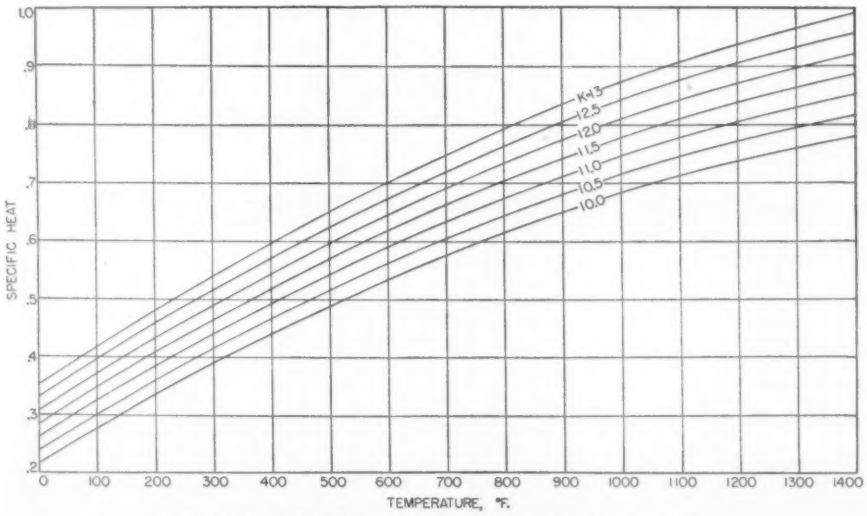

Fig. 2—Specific heats of ideal hydrocarbon vapors

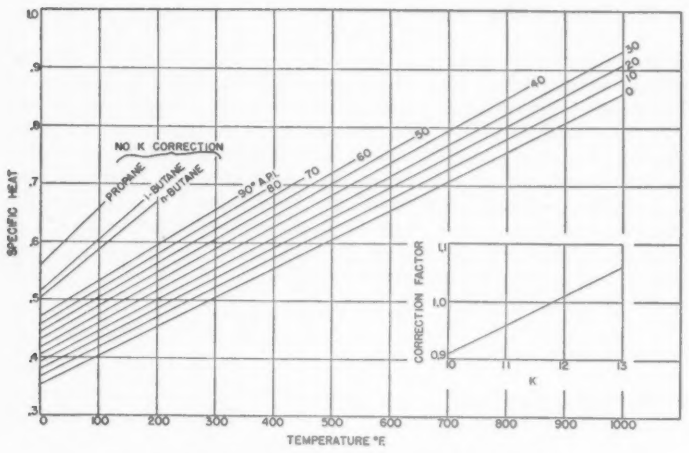

Fig. 3—Specific heats of hydrocarbon liquids

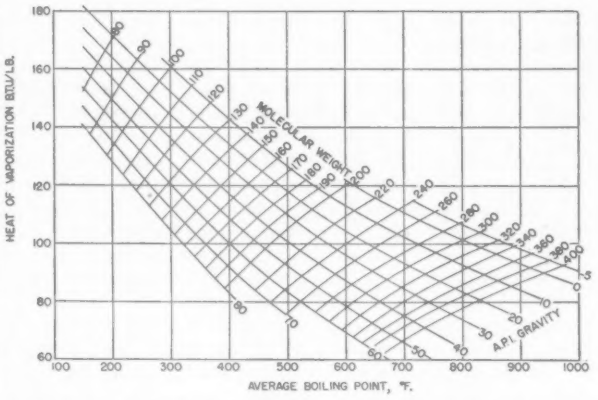

Fig. 4—Heats of vaporization of hydrocarbons (based on molecular weight when available rather than gravity)

equation proposed by Gamson and Watson[5]:

$$\frac{dp}{dT}=\frac{pA}{T_cT_r^2}+\frac{40p(T_r-b)}{T_c}e^{-20(T_r-b)^2} \quad \ldots\ldots (6)$$

By combining Equations 5 and 6, an expression for heat of vaporization is obtained which is accurate at low pressures where the volume of the liquid phase is negligible. The constants for a particular compound may be evaluated from the critical point and boiling point, and a knowledge of vapor pressure constant b as described by Gamson and Watson. This equation yields results which should be more reliable than those from the equation proposed by Watson[15], which was based on the less accurate Calingaert-Davis vapor pressure equation.

Using Equations 5 and 6 in combination with the critical property correlation of Smith and Watson[11] and the molecular weight correlation of Watson and Nelson[16], Fig. 4 was developed to relate heat of vaporization to average boiling point and either A.P.I. gravity or molecular weight. When the molecular weight is available, it should be used in preference to the gravity. The average boiling point should be the "mean average" recommended by Smith and Watson[11] for wide-boiling mixtures.

The values of Fig. 4 are in close agreement with the Kistiakowsky equation for low-boiling compounds but are considerably higher for high-boiling substances. It is believed that this is a preferable means of estimating heats of vaporization of such materials.

Table IV compares calorimetric values with enthalpies of vapors calculated by combination of Equations 3 and 4 with Fig. 4. In general, the calculated enthalpies tend to be lower than the observed, primarily because of the lower specific heats of the vapor state. However, these differences are not much greater than the probable errors in the calorimetric work, and the specific heat correlation could not be raised without becoming inconsistent with the spectroscopic data on the paraffins.

In general it is believed that enthalpies calculated from these relations will be in error by less than 3%, and the relations are reasonably consistent with one another and with the thermodynamic generalizations. Both the accuracy and consistency are believed to be of a higher order than those of previous correlations.

Application of Data

The fundamental correlations of heat capacities and heats of vaporizations are most conveniently used through the construction of enthalpy or heat content charts. An arbitrary reference condition such as the liquid state at 60° F. is conveniently selected for all compounds corresponding to four or more carbon atoms and all enthalpies are expressed in Btu per pound relative to this reference state. For the definition of the reference state of the light gases containing three or less carbon atoms various practices are common. The most logical and generally applicable choice is the ideal gaseous state (zero pressure) at the same temperature used for the reference state of the heavier compounds. This basis involves no hypothetical states, is applicable to the lightest gases and is convenient in a thermodynamically sound method for calculating the enthalpies of mixtures at high pressures which will be developed in a later paper. Its only disadvantage is that negative en-

TABLE III—Comparison of Calculated and Observed Specific Heats and Enthalpies in the Liquid State

Substance	Citation	° API	K	t° F.	Sp. Enthalpy*, B.T.U./Lb. Obsvd.	Calcd.
Gas oil	(6)	34.8	11.86	766	457	454
				859	537	532
Vapor-phase furnace charge	(6)	25.3	11.0	751	406	411
				853	496	491
Refractory gas oil	(6)	18.4	10.4(?)	825	446	445
Cross furnace charge	(6)	28.1	11.24	748	420	418
				827	483	478
					Sp. Heat	
n-Octane	(9)	68.6	12.65	77	0.505	0.508
Benzene	(9)	29	9.7	50	0.394	0.375
				140	0.444	0.418
Tridecane	(9)	54.5	12.75	77	0.500	0.491

*Relative to liquid at 32° F.

TABLE IV—Comparisons of Calculated and Observed Enthalpies of the Vapor State

	Reference state, liquid at 32° F.						
Substance	Citation	° API	K	Av. B.P., ° F.	t° F.	Sp. Enthalpy, B.T.U./Lb. Obsvd.	Calcd.
Naphtha	(17)	58	11.9	250	438	344	340
					949	705	685
Cross furnace charge	(6)	28.1	11.24	530	746	516	502
					863	596	584
Refractory gas oil	(17)	15.3	10.3	505	738	471	474
					1003	607	645
Refractory gas oil	(6)	18.4	10.4	490	826	550	534
Vapor-phase furnace charge	(6)	25.3	11.0	510	750	506	503
					951	661	641
Gas oil	(6)	34.8	11.86	570	749	522	516
					958	671	674

thalpies are encountered in the liquid state at moderate temperatures which offers some slight inconvenience in the preparation of energy balances.

Enthalpies in the ideal vapor state (zero pressure) are most conveniently plotted or tabulated as a function of temperature and characterization factor. Enthalpies read from such a chart are readily corrected to any desired pressure by means of the type of generalized correction proposed by Watson and Nelson[16] and improved by various investigators. The charts are readily constructed from the data here presented. For compounds referred to the liquid state the heat of vaporization at the normal boiling point from Fig. 4 is corrected to the reference temperature by means of the following equation[15]:

$$\lambda = \lambda_b \left(\frac{1 - T_r}{1 - T_{r_b}} \right)^{.38} \quad \ldots\ldots\ldots\ldots\ldots (7)$$

where λ and λ_b are the heats of vaporization at the reference temperature and the normal boiling point respectively, and Tr and Tr_b are the corresponding reduced temperatures. If the vapor pressure at the reference temperature is low, λ from Equation 7 may be taken as equal to the enthalpy of the ideal vapor at the reference temperature. If the vapor pressure is appreciable, the enthalpy of the saturated vapor at the reference temperature should be corrected to zero pressure. Enthalpies at other temperatures are readily calculated by integration of the heat capacity equations.

This article is the second of a series dealing with the development and correlation of fundamental physical chemistry data required by refinery process engineers for efficient design of plants and equipment. The studies reported are part of the graduate research program in chemical engineering being conducted at the U. of Wisconsin, and are incidental to a chief research project in catalysis and kinetics. The first article appeared in the May 3 issue, pp. R-258-264—"Vapor Pressures and Critical Properties of Organic Compounds."

In the temperature ranges indicated by the curves of Fig. 3, the heat capacities for the liquid state may be taken as corresponding to the critical pressures. These data may be used to prepare tables or charts relating the enthalpies at the critical pressure of hydrocarbons of 11.8 characterization factor to °API and temperature. Values for other characterization factors are obtained by multiplying by the correction shown on Fig. 3. Generalized charts are available[15] for correcting enthalpies of liquids from the critical pressure to any other pressure. These corrections are ordinarily negligible in the temperature range of Fig. 3 except at high pressures.

The enthalpies of liquids at temperatures above the range of Fig. 3 are best approached from the enthalpy of the ideal gas. The enthalpy of the gas is corrected to the saturation pressure and the enthalpy of the saturated liquid obtained by subtracting the heat of vaporization calculated from Equation 7. The enthalpy of the liquid at any other pressure may be calculated by the generalized pressure correction charts[15].

If desired, a complete relationship between enthalpy, temperature, and pressure for a single compound is readily established in this manner for a wide range of conditions, including the critical region. However, such charts are not useful for obtaining the properties of mixtures except under conditions where ideal solutions are formed.

Acknowledgment

This work was made possible through the financial support of the Wisconsin Alumni Research Foundation. The helpful suggestions of Paul Bender are gratefully acknowledged.

Nomenclature

A = constant in vapor pressure equation
$°API$ = A.P.I. gravity
a, c = constants in heat capacity equation
b = constant in vapor pressure or heat capacity equation
C_p = specific heat at constant pressure
c_p = molal heat capacity at constant pressure
G = specific gravity, 60°/60° F.
K = Universal Oil Products Co. characterization factor = $(T_b)^{1/3}/G$
p = pressure
R = gas law constant
T = temperature, ° Rankine
T_b = normal boiling point, ° R.
T_c = critical temperature, ° R.
T_r = reduced temperature
t = temperature, ° F.
u, v = constants in heat capacity equation
z = compressibility factor, pv/RT
λ = molal heat of vaporization

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Presented before the Division of Petroleum Chemistry at the 106th meeting of the American Chemical Society, Pittsburgh, Sept., 1943.

BOOKS FOR REFINER

'Handbook of Chemistry' Revised and Enlarged

Among the most valuable books in the library of any refinery man, engineer or otherwise, are the reference handbooks which provide him with a tremendous fund of readily available information. Probably most familiar of these handbooks in the fields associated with chemistry is *"Lange's Handbook of Chemistry,"* the fifth edition of which has just been issued. As in the past, it has been compiled and edited by Norbert Adolph Lange, Ph. D., lecturer in chemistry at Cleveland College of Western Reserve University.

Perhaps the most important change in this edition is the completely revised and enlarged table of Physical Constants of Organic Compounds. It now lists 6507 compounds, and more than 3500 synonyms.

New material not contained in previous editions of the handbook includes tables of flammable liquids, flame temperatures, plastics, and water for industrial use. In addition, other tables have been extended and brought up-to-date.

Copies of *"Lange's Handbook of Chemistry"* (2092 pages, flexible cover) may be obtained through the Book Department of NATIONAL PETROLEUM NEWS, 1213 West Third St., Cleveland 13. Price is $6.00, postpaid.

* * *

Linde Handbook Explains Oxy-Acetylene Welding

"The Oxy-Acetylene Handbook," published by the Linde Air Products Co., provides a complete, comprehensive, and authoritative textbook on basic oxy-acetylene welding and cutting procedures. It covers the entire range of the oxy-acetylene process, giving instructions for handling all the common commercial metals. It also includes simple explanations of the fundamental principles of the various methods of depositing and controlling molten metal. Considerable space is devoted to an explanation of the operating principles of oxy-acetylene equipment and instructions for its care and maintenance.

The book will be of interest to those who are responsible for training welding and cutting operators. It will also serve as a guide and reference book for management personnel, engineers, designers, superintendents, foremen, and operators in plants where oxyacetylene welding and cutting is used in either new construction or maintenance.

The text is well illustrated, and contains a 65-page data section in the appendix. Copies of *"The Oxy-Acetylene Handbook"* (587 pages, 6 x 9 in., stiff cloth binding) can be obtained through the Book Department of NATIONAL PETROLEUM NEWS, 1213 West Third Street, Cleveland 13, for $1.50.

Wartime Refining Brings New Corrosion Problems

Wartime conditions have increased corrosion difficulties for many plant operators.

New methods of processing which call for the use of a wider variety of chemicals as catalysts and other types of reagents have added new corrosive compounds for refiners to cope with. The increased running of sulfur crudes is adding to the volume of corrosive gases and liquids to be handled in some plants.

At the same time, the need for the conservation of critical metals has made it necessary for operators to use sparingly or forego entirely the use of some of the corrosion resisting metals with which they had previously had experience. However, substitute materials have been found and new techniques have been developed for protecting the walls of vessels, furnace tubes and other equipment.

Modern methods for combating corrosion problems in oil industry operations were discussed before the National Assn. of Corrosion Engineers meeting in Houston April 10-12. In the following pages are presented three papers given there on corrosion in refineries and gasoline plants.

Refinery Corrosion Problems Reviewed*

Causes of corrosion from oil and water in refineries and natural gasoline plants are reviewed and principal points of attack described. Experiences are given in combating corrosive tendencies of three types of water in the plant cooling water system.

*By Ivy M. Parker***

FOR economic reasons the solution of any corrosion problem pays dividends. During wartime the conservation of materials is equally important.

Refinery corrosion problems begin when the crude enters the refinery and do not cease until the products line leaves. In the Gulf Coast area we have four corrosion problems: (1) oil, (2) atmosphere, (3) soil and (4) water. I propose to discuss briefly the corrosion of steel in contact with the first and last, namely oil and water.

The corrosion problems associated with the metals in contact with the oil may be classified into two groups—those associated with sweet crudes and those with sour crudes. The former are very minor when compared with those encountered with sour crudes. The sour crude problems may be classed as those associated with low temperatures (below 500°F.) as in crude units, contrasted with high temperature corrosion, as in cracking unit furnace tubes. This last problem has been attacked mainly by installing alloy metal tubes which will withstand the conditions encountered.

Corrosion problems are very specific and no general remedies can be given. Some conditions with which I am familiar, along with steps which have been taken in an attempt to improve them, are cited.

I shall touch very briefly upon crude pipeline corrosion, as my experience with this problem has been very limited. A few sections of line that had been removed because of failure have been examined. Here the internal corrosion appeared to be more severe on the bottom side, indicating some relation to the moisture content. I have assisted in examining the white material resulting from electrolytic corrosion of pipelines to identify ferrous iron, probably present as hydroxide. This problem of electrolytic corrosion of pipelines is a very vital one in the refinery setup.

Following the crude into the refinery, it is well known that steel tanks suffer greatly in the presence of sour crudes or unsweetened sour products. Tank bottom corrosion arises from attack from water settling from the crude (the severity usually depending upon the pH of the water) and from scale, containing sulfide and free sulfur, falling from the roof to the floor. These scale particles apparently set up highly anodic points and produce severe pitting. The roof and top ring of the tank suffer severely from the damp sulfide atmosphere containing some air. Free sulfur is liberated and deposited to produce specific anodic areas and pitting.

As a rule very little corrosion takes place in the sweet crude storage tanks, provided the settled water is not acid. Sweet crudes appear to be acid mainly when the wells have been acidized and the crude improperly washed. Our friend, or enemy, magnesium chloride is usually associated with sour crudes. Gunnite has proved a valuable tool in reclaiming rapidly failing tanks. The life of both roofs and bottoms have been extended greatly by applying this special cement or concrete.

Corrosion in the refinery crude unit is most pronounced in condensers, coolers and run down lines. This problem is always associated with hydrochloric acid production, either from acid present in the crude or that produced by hydrolysis of magnesium chloride, and/or sulfide production, with the combination being worse than either alone. The point of attack in these instances is definitely associated with the initial condensation of moisture.

Two Methods of Attack

This problem has been attacked by two methods—(1) desalting the crude and (2) neutralizing the acid constituents at the point of condensation. The first when effectively carried out materially reduces the corrosion. The second, usually employing caustic or ammonia with or without flushing with water, is of great benefit but does not solve the problem. Ammonia has gained preference over caustic because less difficulty is experienced with salt choking. In prewar days the general practice was to construct condensers and coolers of admiralty metal bundles with steel or cast iron shells. Then the problem was to neutralize effectively the acid condensate as formed. The success of the operation depended upon a balance between the proper neutralization of the acid without undue attack of the admiralty by the ammonia. By custom the control has been to adjust the pH of the water drawn off to 7.5 to 8.0. This did not solve the problem because frequent replacement of condenser bundles, steel shells and run down lines were still necessary. A Monel spool in the rundown line from these condensers was in good condition at the end of 3½ years.

With the material shortage experienced in recent months, it has been necessary to replace the admiralty bundles with steel. In one such case the ammonia injection was increased to raise the pH of the condensate to between 8.5 and 9.0. The steel tube bundles lasted only three to six months. Admiralty tubes under similar conditions, except pH of 7.5, lasted six to 12 months.

It has been proposed that organic chromium compounds be injected into the vapor line above the condensation point which would inhibit the steel against attack. An attempt to try this material was abandoned because of mechanical difficulties.

The corrosion in the products pipelines has been proved to be associated with the water accompanying the oil. The problem has been attacked by reducing the quantity of water to a minimum, applying scrapers periodically to remove products of corrosion, and by adding water-soluble corrosion inhibitors. Of these sodium nitrite has given excellent results.

Corrosion is also an important problem in the cooling water system of the refinery. As in all other types of corrosion we have anodic and cathodic areas with the metal going into solution at the anode. In neutral or slightly alkaline medium the corrosion products form a barnacle or tubercle covering the anodic

*Presented before National Assn. of Corrosion Engineers, Houston, April 10-12, 1944.

**J. S. Abercrombie Co., Old Ocean Refinery, Houston.

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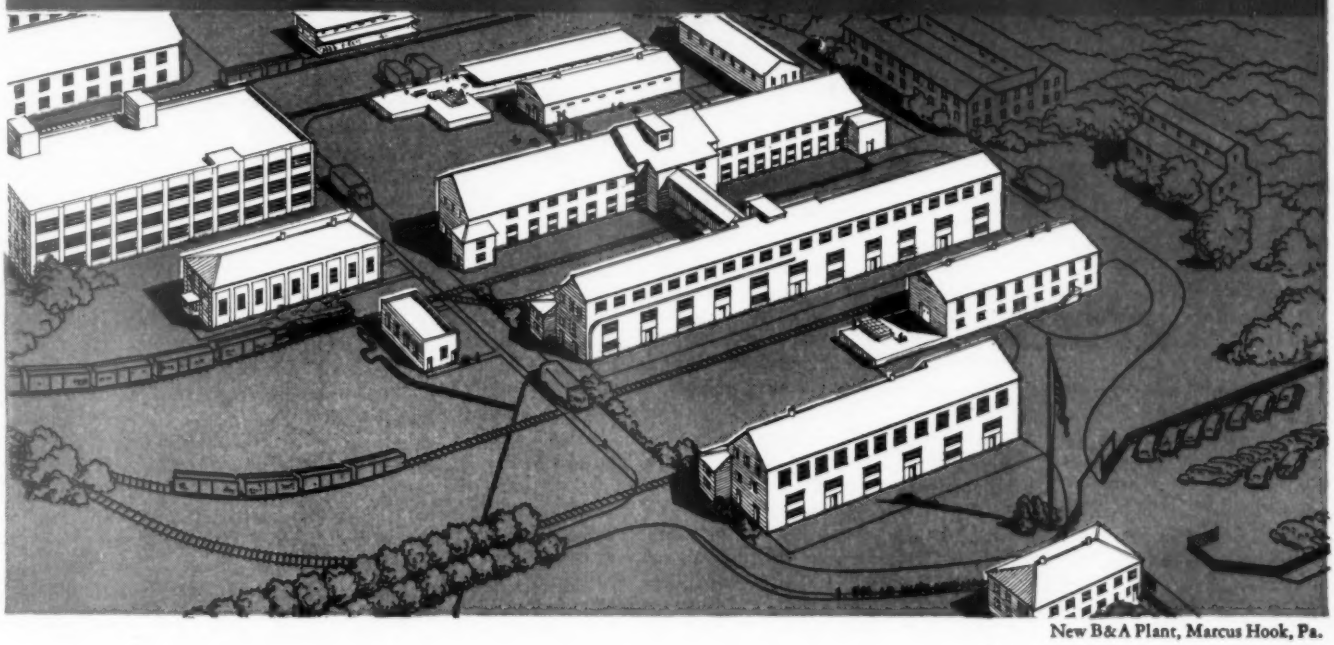

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area. Thus, there is the problem of loss of metal coupled with reduction in capacity.

The average refinery cooling water system consists of the make-up source, heat exchangers and cooling tower, with the water circulating through the tower every 15 to 30 minutes. Each time the water passes over the tower, it becomes practically saturated with air, besides picking up corrosive gases such as CO_2, H_2S and SO_2.

Some of the factors which contribute to water side corrosion are dissolved oxygen, oil, sulfide and composition of metals. The principal means of combating it are the use of water soluble rust inhibitors, natural or added. Deaeration has been used effectively and cathodic protection has been applied with considerable success in some cases.

Fundamentally our cooling water corrosion involves the following reactions:

Anodic:

$$Fe^0 - 2(-) = Fe^{2+}$$

Cathodic:

$$O_2 + 2H_2O + 4(-) = 4OH^-$$

As indicated by the reactions, the process is under cathodic control with an alkaline condition existing at the cathode area and the iron going into solution at the anodic area. This reaction may be inhibited by restricting the oxygen content as in deaeration or by covering the cathodic area with a film which is not permeable to oxygen. It may also be inhibited by restricting the rate or reaction at the anode. Normally the corrosion product is a complex iron oxide which is permeable to the passage of chloride ions and water and does not materially stifle the reaction. In addition, an area of low oxygen concentration is established which, in conjunction with the air saturated cooling water, sets up ideal conditions for oxygen concentration cells. Thus the intensity of the corrosion increases.

You are probably familiar with Evans'(1) classification of inhibitors as safe and dangerous, which in reactions under cathodic control apply to cathodic and anodic inhibitors. He defines as cathodic those inhibitors which stifle the corrosion by limiting the cathodic area, thereby decreasing the intensity of corrosion without reducing the area affected. The anodic inhibitor initially stifles the anodic area without reducing the intensity and will temporarily increase tendency of pitting. If insufficient inhibitor is applied the latter condition will continue to exist. For this reason Evans classes the anodic inhibitor as dangerous. Chromates and silicates fall into this class in very soft waters. In hard waters silicates appear to have some cathodic effect as well as anodic. Controlled calcium carbonate precipitation is definitely cathodic in action.

My experience with water corrosion is limited to three types of water—aerated soft high bicarbonate, unaerated soft bicarbonate and soft low alkalinity water, the greater portion being with the soft bicarbonate water. Typical analyses of these waters are shown in Table 1.

A plant started up on the soft bicarbonate water shown in Analysis No. 1 did not show serious corrosion until after sodium hexametaphosphate had been introduced as a scale inhibitor. It was assumed that the phosphate brought about the removal of the natural inhibitor, $CaCO_3$, present in the water. Abandonment of the hexametaphosphate for a period of six months did not appear to reduce the corrosion rate and the scaling in the hot sections made it necessary to reapply the phosphate.

Two corrosion inhibitors were applied along with the phosphate with considerable success. In systems where there was a buildup of solids due to concentration, the D. W. Hearing Co. Quachrom was used in concentrations of 35 to 50 parts per million with very good results. In systems where less than three concentrations of solids was obtained, sufficient 40° Bé sodium silicate was added to raise the normal SiO_2 content 10 to 20 parts per million. The results were excellent in the oil-free systems. In systems containing oil and sulfide there was great improvement, but the results were still none too good.

(1) Evans, U. R., "Inhibitors, Safe and Dangerous", Electrochemical Society Transactions, 69, 213 (1936).

TABLE 1—Typical Analyses of Three Types of Water

Properties	Soft High Bicarb. 1	Unaer. Soft Bicarb. 2	Soft Low Alkal. 3
SiO_2, ppm	12	22	10
R_2O_3, ppm	1	3	1
Calcium, ppm	7	7	10
Magnesium, ppm	2	31	5
Sodium, ppm	169	...	37
Carbonate, ppm	0	0	0
Bicarbonate, ppm	352	278	55
Chloride, ppm	73	1360	45
Sulfate, ppm	11	0	14
Organic material, ppm	...	519	...
Dissolved solids, *ppm	451	2108	148
pH	8.0	8.0	8.0

*Calc. with bicarbonate converted to carbonate.

The water represented by Analysis No. 2 was pumped from the well directly through the units, and therefore was not aerated. It contained considerable dissolved gases and some CO_2. The corrosion from this water was only tube-end corrosion and appeared to be associated with turbulence. The tube ends were protected by applying a paint, Debecote, which has proved successful.

The water represented by Analysis No. 3 was lime softened water and was introduced into a cooling system containing considerable oil. The loss of water from the system was great enough to prevent more than 1.5 concentration of solids. Severe corrosion set up in the system in a short time. Application of sodium silicate was started to effect a decrease in number of active areas but at present serious pitting is still taking place. The next steps to be taken are removal of the oil and elimination of some of the water waste.

Uses of Clad Steels to Combat Corrosion*

The discussion concerns principally the type of clad steels in which nickel, copper and their alloys are bonded to steel base plate. The clad steels can be fabricated in the plant shop with reasonable care and supervision. Designing of equipment for clad steels follows that for similar equipment in commercial steel. Precautions for handling are required to protect the clad surface. Procedure for welding these types of steels is described.

*By Martin J. Conway***

THE development of clad steels was the outcome of a desire to provide an economical thickness of corrosion-resistant metals, as compared with solid material of similar analysis, which could be used in the fabrication of vessels, tanks, agitators, towers, heat exchangers and other operating and storage equipment, which would contribute to a lower finished cost without sacrifice of structural strength. The more important clad metals are covered in the list in Table 1.

It is the purpose of this article to deal with the first group of these clad steels, compositions and properties of which are shown in Table 2. They are manufactured by the heat and pressure method, which produces a permanent and efficient bond between the cladding metals and the steel base plate. The composite slabs are put together in sandwich form, heated to 2300° F., and rolled in a heavy plate mill under tremendous pressure. This pressure on the white-hot composite assembly reduces its thickness, while plastically bonding the clad metal and steel together. This method also protects the clad surface from contamination during hot rolling.

The designing of equipment for clad steels follows that for similar equipment

*Principal portion of a paper presented before National Assn. of Corrosion Engineers, Houston, April 10-12, 1944.

**Manager Petroleum Division, Lukens Steel Co., Coatesville, Pa.

in commercial steel. Since the thermal coefficients of expansion of the nonferrous clad material and steel are approximately the same within the range in which these clad metals are used, the bond is not affected and maximum heat transfer efficiency is provided. See Table 3.

The economic design of equipment is also aided by the availability of large plates and heads. Clad steel plates 1 in. thick may be supplied in one piece up to 138 in. square, or 335 in. long by 60 in. wide; and plates ½-in.-gauge may be obtained up to 162 in. square or 480 in. long by 84 in. wide, with head sizes comparable with the square plate sizes mentioned.

In contrast to the use of postage stamp sizes of plates, wide clad steel plates save time, manpower and money in the fabrication of pressure vessels and other equipment. By minimizing the number of operations required, such as trimming, bending, forming, edge preparation and welding of additional seams ordinarily needed when several narrow plates are used, wide plates reduce fabricating costs and make it possible to increase shop production by permitting a greater number of units to be fabricated without increase in plant area or equipment. In fact, in all applications involving clad steel plates, the widest plate available can always be employed with resulting saving on fabrication costs, despite the width extras involved.

Clad steels are used extensively in petroleum refining and natural gasoline manufacture. They are essential because of three conditions under which raw materials are converted into finished products:

1—Some raw materials, both crude oil and natural gas, are corrosive because they contain impurities.

2—In others, heat converts foreign compounds into corrosive substances in the conversion process.

3—Refining agents, such as acid catalysts, set up corrosive reactions as part of the process.

Refining employs two methods of combating corrosion. One is to treat raw materials ahead of processing, in which case the treating equipment may require clad steels; or clad steels may be adopted to combat corrosive action while refining is in progress. An example of the expanding use of clad steels is found in the trend to use this material in heat exchangers, reactors, towers and downspouts.

The need for corrosion-resisting metals is indicated by the corrosive nature of the chemicals essential to refining, either as products or processes or as treating and catalytic agents. The substances in the list in Table 4 are either corrosive in themselves, or may become corrosive in the presence of other agents.

Heat and pressure are in part responsible for converting otherwise noncorrosive materials into corrosive ones. Cracking, with its attendant of higher temperatures and higher pressures, is often the cause of corrosive compounds.

TABLE 1

List of Important Clad Metals

1—Nonferrous:
- Nickel
- Monel
- Inconel
- Copper

2—High chromium-nickel steels:
(With and without columbium or molybdenum)
- Low carbon, 18% chromium, 8% nickel
- Same as above, plus columbium
- 18% chromium, 8% nickel, 2.5% molybdenum
- 18% chromium, 8% nickel, 3.5% molybdenum
- 25% chromium, 20% nickel

3—Plain chromium steels
(Not exceeding 27% chromium)
- Low carbon, 12% chromium
- Low carbon, 17% chromium
- Low carbon, 27% chromium

Distillates which are the products of cracking are more difficult to treat than those from ordinary distillation. They require more extensive use of chemicals or adoption of the more recent catalytic treating processes. In each instance, clad steels are recommended. In these processes a chemical or an oxide divides or unites hydrocarbons without becoming part of the final product. For instance, two types of hydrocarbons which naturally have no inclination to combine unite readily in the presence of 98% concentration of sulfuric acid. This is the basis of catalytic alkylization, source of part of several materials which are blended to make 100-octane aviation gasoline.

A phase of these processes is the recovery and regeneration of the catalyst, which adds to the necessity of clad steels to resist corrosion.

Identities of many catalysts are not generally known or cannot be stated at this time, hence types of clad steel requirements are known only to patent holders. It is significant, however, that pressures range from 50 lb. to 3500 lb., and that the temperature variation is from sub-zero to 1400° F.

Although there is a trend toward catalytic treating, most of the finished materials from refining plants are treated with chemicals, among those used being caustic soda, sulfuric acid and sodium plumbite. Since these chemicals must be revivified to desired concentrations, clad steels and solid alloys are used in service vessels, lines, pump parts and fittings.

Copper salts are among the leading catalytic treating methods. These are usually subjected to caustic washing, either before or after the catalytic contact.

For hydrogen sulfide removal from natural gas, used largely in natural gasoline plants, phosphate and phenolate are used.

Tank car construction has already used a considerable amount of clad steels, and with the petroleum industry's large contribution to the heavy chemical field such applications should increase.

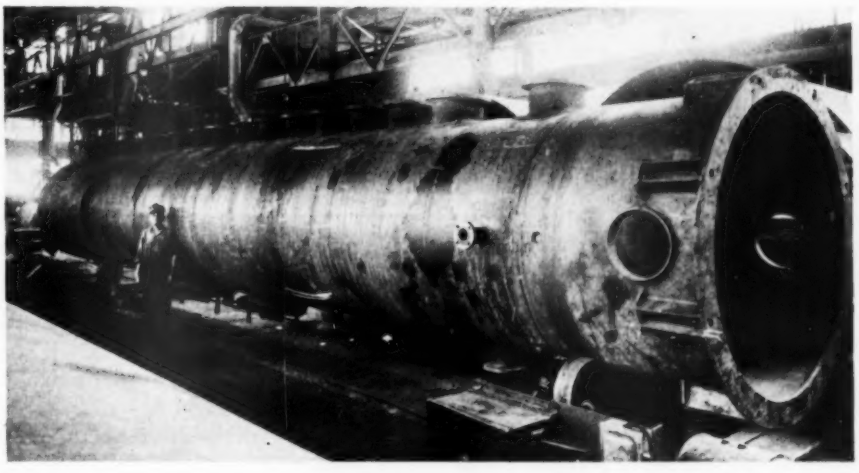
The many types and sizes of vessels which have been fabricated from clad steels indicate that this work can be done in any commercial shop or progressive maintenance shop employing reasonable care and supervision in the fabrication of any of its products.

The customary precautions employed for any quality material by the fabricator will not require any great modification in the handling of clad steels.

Protect Surfaces

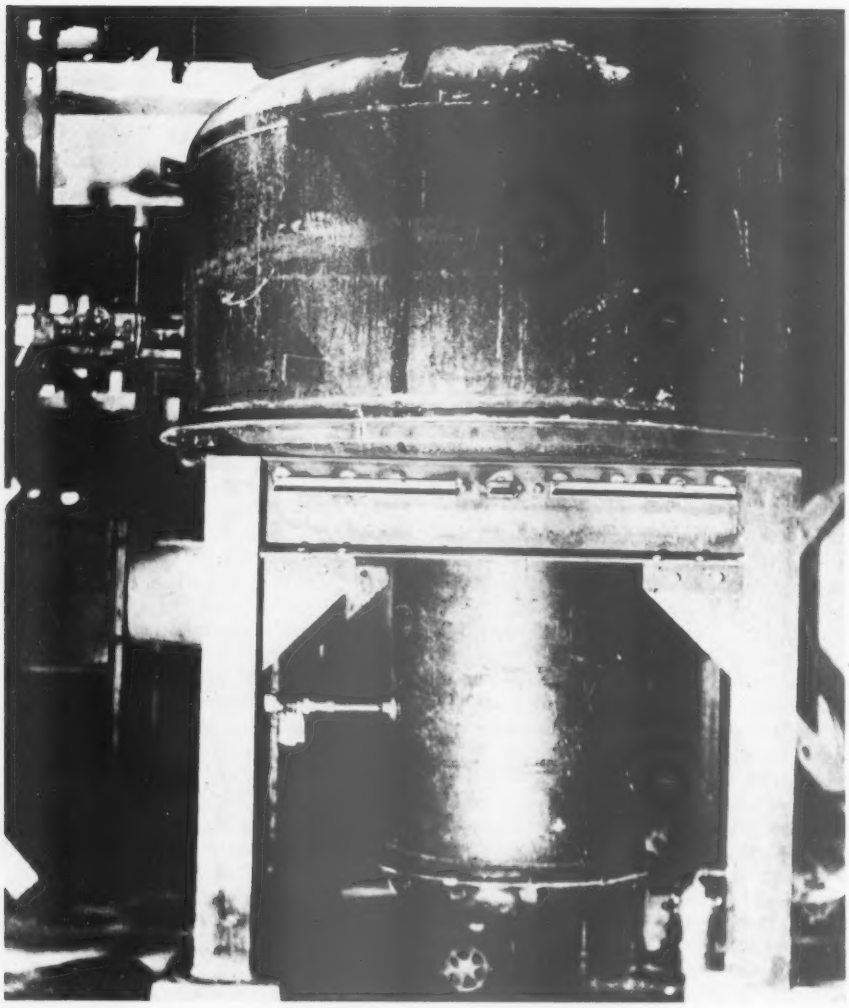
In order to protect the clad surface during shop operations, it is important to exercise care to avoid marking or scratching the clad surface. This will also prevent the possibility of embedding iron particles in the clad surface, which may cause corrosion at this point resulting in product contamination in service later. The top roll for forming the shells should be cleaned or covered with paper to prevent contaminating the surface of the cladding by iron particles from the rolls. The clad plate should be moved around the shop with the clad side up to protect the surface of the cladding.

The edges of the composite plates are beveled for welding by machining in the usual manner as shown in Fig. 1. One of the most important changes neces-



(Photo from Lukens Steel Co.)

Distillation tower, 6 ft. I.D. by 43 ft. 6 in. long. Upper portion, 15 ft. 6 in. long was fabricated from 23/32 in. Monel-clad steel



Liquid salt circulating tank, operating at 1000° F., fabricated by Socony-Vacuum Oil Co., Inc., Paulsboro, N. J., of 20% nickel clad steel

sary to the welding of most clad steels must be taken into account at this point because of possible metallurgical reactions.

In most cases, the steel should not be beveled to include the cladding in the bevel and some steel should be left at the lip above the cladding before starting the bevel. While the steel side is welded with a commercial steel electrode and the clad side with the appropriate nickel or nickel-alloy welding electrode, the procedure to be followed in depositing the first steel bead in the bottom of the groove is extremely important.

This bead should be run with the amperage on the low side of the recommended current range in order that penetration will not be excessive and the metal will be deposited "cold".

If the first steel bead penetrates and absorbs the clad surface, the steel bead will become hard and subject to cracking. This pick-up of the clad metal in the steel weld metal produces a martensitic structure which results in high hardness and low ductility of the welded metal. The first bead may crack, requiring chipping and rewelding, or it may be just hard enough to lower the ductility of the completed weld to a degree that it will fail to meet the required elongation specifications during the physical testing of the welded coupons.

However, this difficulty is avoided by leaving 1/16 in. of steel in addition to the clad thickness, and at the same time running the first steel bead "cold" in the bevel between the edges to be joined.

For plates up to ½ in. thick, the straight "V" groove with a 70-degree included angle is preferred, whereas for plates ½ in. and thicker, the "U" groove should be used.

The same machine tools and methods employed for steel should be used for the beveling of clad steels. The abutting edges should fit together with the same accuracy as required for any quality workmanship, such as specified by the various code requirements. In fact, the offset between the meeting edges should not be greater than the thickness of the cladding, or closer if possible.

The code requirements stipulate that such alignment tolerances must be held; and they should be maintained not only for appearance, but also to prevent the pick-up of the clad metal in depositing the first steel bead.

Although the fit-up requirements are no more stringent than those for ordinary steel, carelessness in fit-up should be avoided at all times whether limitations are imposed or not.

The first steel bead is deposited in the bottom of the groove with the same care as in welding of regular quality steel, with the additional precaution that penetration should be carefully controlled. As in any ordinary steel, each bead is brushed to remove welding slag, and the succeeding beads are deposited to fill the groove.

In welding plates up to 1¼ in. thick, the steel side may be completely welded before shipping and welding the clad side. However, for plates heavier than

TABLE 3

	Mean Coefficient of Thermal Expansion	
Nickel	0.000013	(27°-100° C)
Monel	0.000014	(25°-100° C)
Inconel	0.0000115	(38°- 93° C)
Flange Steel	0.0000119	(25°-100° C)

TABLE 4

Chemicals Essential in Refining Which Are Either Corrosive in Themselves or May Become Corrosive in Presence of Other Agents

Acetone	Ethylene chloride
Alcohol	Ethylene dichloride
Alipatic amines	Formaldehyde
Ammonia	Furfural
Analine	Hydrochloric acid
Benzol	Lime
Brine	Magnesium chloride
Calcium chloride	Methylethyl ketone
Carbon dioxide	Naphthenic acid
Carbon monoxide	Nitric acid
Carbon tetrachloride	Nitrobenzene
Caustic soda	Petroleum ether
Chlorinated solvents	Phenol
Chlorine compounds	Potassium carbonate
Chromic acid	Potassium isobutrate
Chromium oxide	Sodium phenolate
Clay slurries	Sodium sulfide
Cresylic acid and cresol	Sulfur
Cupric chloride	Sulfur dioxide
Cuprous chloride	Sulfuric acid
Diethylene glycol	Toluene
Dimethyl ketone	Tripotassium phosphate
Dipenyl and dipenyl oxide	Zinc chloride

TABLE 2—Nominal Compositions and Mechanical Properties of Nickel, Inconel and Monel Metals

	Nominal Compositions %						
	Ni %	Cu %	Cr %	Fe %	Mn %	Si %	C %
Nickel	99.4	0.1	..	0.15	0.2	0.05	0.1
Inconel	79.5	0.2	13.0	6.5	0.25	0.25	0.08
Monel	67.0	30.0	....	1.4	1.0	0.1	0.15

	Mechanical Properties (Hot Rolled Plate)			
Metal	Yield Point 1000 psi	Tensile Strength 1000 psi	Elongation % in 2 in.	Brinell Hardness
Nickel	20-75	70-100	45-30	100-200
Monel	40-90	80-110	45-20	140-220
Inconel	45-95	100-140	40-20	160-240

1¼ in., it is at times helpful to only partly fill the steel groove and, without completing it, chip and weld the clad side, to be followed by completing the steel side of the joint. This practice reduces the amount of warpage and overcomes the tendency to crack as a result of the extension of the unfused area in the form of a stress crack up through the steel bead.

Arc Welding Effective

While other methods of welding, such as oxyacetylene, carbon arc and atomic hydrogen, may be used for the welding of clad metals, the preferable method and the one most commonly used is the metal arc method. Electric arc welding is especially desirable when welding the nickel side, as the conditions are much easier to control.

Cold operations, such as bending, flanging, forming, shearing, beveling and the like, are performed exactly as in commercial steel plate work. No change in equipment or provision for special tools is required. Severe cold operations, such as pressing heads and die work, generally require annealed plate.

In these emergency times, rare metals have to be strictly rationed, owing to urgent demands for war purposes. Whenever it is possible to substitute clad plate for solid rare metal, it will help to conserve available supplies, and in addition will contribute suitable material for important processes that could not be handled simply by the use of steel plate.

The following advantages will influence the choice of corrosion-resistant clad steel plate for process equipment:

1—Prolonging life of equipment through ability of cladding to resist corrosion under service conditions.

2—Protecting quality of products manufactured or processed in the equipment, and preventing harmful contamination or discoloration of the products by metallic salts. (In some cases, contaminated products may act catalytically.)

3—Assuring ease of cleaning and sterilization, thus checking bacterial growth and promoting sanitation; preventing adherence of products (as may be the case with a surface that has been roughened by corrosion), and improving heat transfer, where this is a consideration.

4—Reducing maintenance cost of equipment; involving not only actual cost of replacing materials and necessary labor, but also time and production loss with inferior plant processing equipment.

5—Reducing cost of equipment by reducing thickness of metal used. (In many cases, with metals that are not particularly resistant to corrosion, it is necessary when designing equipment to use extra-gauge materials to allow for corrosion attack during the intended life of the equipment. Also, consideration must be given to the higher physical properties in some corrosion-resistant materials which may permit the use of lighter-gauge plate to obtain the same strength.)

Among typical uses for clad steel plates and heads are distillation towers, heat exchangers, agitators, storage tanks and digestors, as well as other services in the petroleum, synthetic rubber, explosive manufacturing and chemical industries.

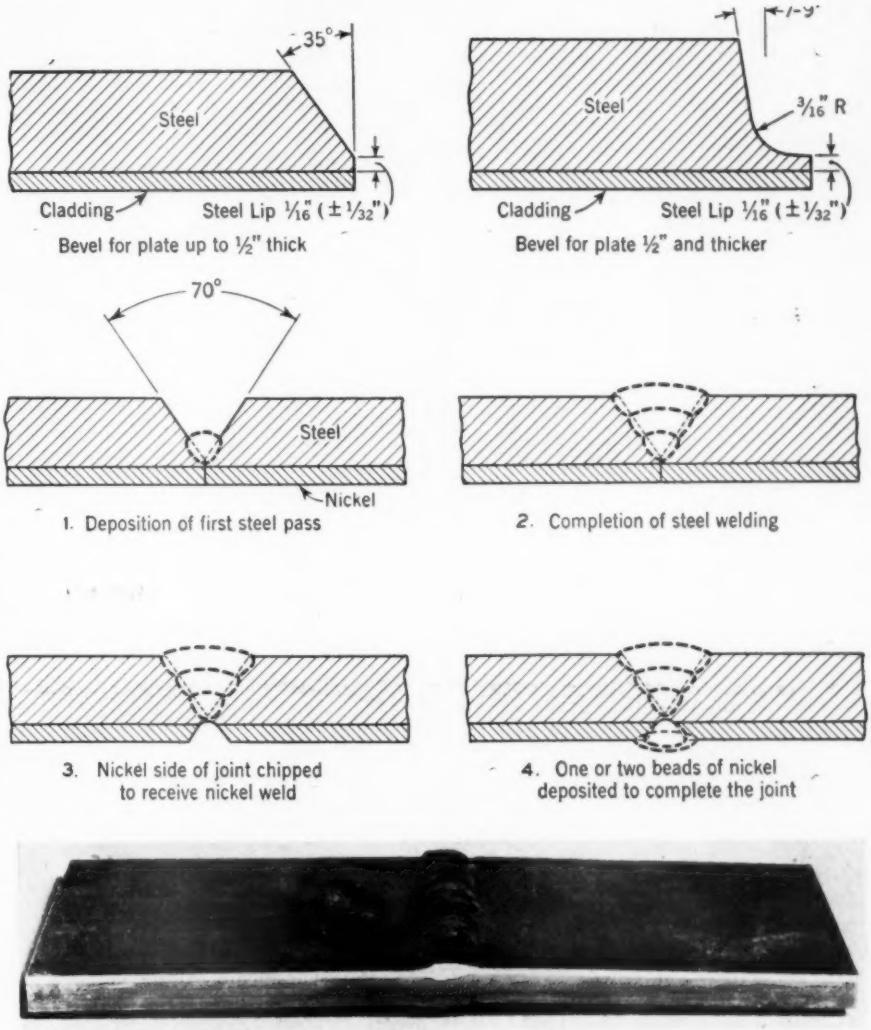


Fig. 1—Welding sequence for nickel-clad steel. The same sequence is followed for welding Monel-clad and Inconel-clad steel plate, except that Monel and Inconel electrodes respectively are used for welding the clad side

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Use of Nickel Alloys to Resist Corrosion*

*By B. B. Morton***

CORROSION has always presented difficult problems in the petroleum industry. The production and refining divisions are particularly subject to corrosion of equipment. With recent advances in refining technique a number of reagents have been introduced that have greatly increased the corrosiveness of the material handled. Among these reagents are hydrofluoric acid, sulfuric acid, hydrochloric acid, phosphoric acid and a number of solvents such as phenol and furfural. Regeneration of caustic has also raised the question of suitable tubes for the boiler and material for the linings of equipment.

The equipment used in refineries is probably the most viciously assailed by the greatest variety of corrosives of any equipment in the whole industry. Refinery corrosion is sharply controlled by

*Presented before National Assn. of Corrosion Engineers, Houston, April 10-12, 1944.

**Development and Research Division, International Nickel Co., Inc., New York.

temperature as to character and intensity. In general the character of attack changes with the presence or absence of liquid water. This permits setting a range line of change in attack at about 500° F. Above this temperature the attack is usually directed upon the metal and often results in forming a scale which is a metallic compound.

Below the temperature of about 500° F. the attack is usually of the electrolytic type and is governed by factors influencing this type of corrosion, as for instance, differences in potential, overvoltage, oxygen, etc.

At elevated temperatures the two chief sources of attack at the present time are sulfur and naphthenic acids.

To protect against sulfur attack at high temperatures, in excess of 500° F., there must be increasing quantities of chromium in the alloy. Twelve-14% chromium steel, also 18% chromium-8% nickel alloy steel strip welded with the same material or, preferably, with 25% chromium-20% nickel rods, are widely used to line reaction vessels. Tubes of 18-8 are used and this alloy is also extensively used as a valve trim and in parts.

Naphthenic Acid

Where the attack is from naphthenic acids at elevated temperatures, 800° F. and above, the 18% chromium-8% nickel alloys with 3% molybdenum or Inconel (approximately 80% nickel, 13% chromium) are apparently the most resistant of commercially available alloys. Carbon steel, 18-8, and many other alloys are rapidly destroyed by naphthenic acids under conditions favorable to attack.

At temperatures low enough for liquid water to exist, the attack is usually best resisted by Monel (67% nickel-30% copper), or pure nickel, in the case of weak concentrations of acids. At high concentrations, the special nickel-containing complex alloys are used as the Hastelloy group (nickel-iron-molybdenum alloys); Illium (nickel-chromium-iron-molybdenum); Pioneer Metal (approximately 65% nickel, chromium and molybdenum); Worthite (nickel-chromium-silicon-molybdenum), and others.

Hydrochloric Acid

Weak concentrations of hydrochloric acid are generated in cracking equipment from salts contained in the crudes. Monel is used as caps and trays, also as lining material for towers, condensers and other vessels where the metal temperature will not exceed 500° F. In the case of isomerization using an atmosphere of HCl, the Hastelloy B appears by test to offer a high order of resistance. Nickel is also being tried and is under present observation in an important installation. A judicious use of Hastelloy B and nickel or Monel is suggested in connection with isomerization units.

Sulfuric Acid

The alkylation of petroleum fractions is important in the 100-octane program. Sulfuric acid in concentrated form is used as a catalyst. Hastelloy D (a cast alloy of nickel and silicon) is most resistant of high strength alloys to all concentrations of sulfuric acid. The cast nature and low ductility of this alloy somewhat limit its use.

Hastelloy B is very resistant to pure sulfuric acid and satisfactorily so to acid contaminated by the usual material encountered in refineries. This alloy is especially useful where a wrought material is required. It is applied as parts of pump, valves and fittings. The corrosion rate of Hastelloy B increases rapidly if copper is a contaminant of the sulfuric acid.

LaBour R-55 and Worthite are also used, especially in pump parts to handle high concentration of sulfuric acid. Valve parts of these alloys are reported to give satisfactory service in contact with sulfuric acid.

Hydrofluoric Acid

Hydrofluoric acid is used to catalyze the alkylation reaction in the formation of high-octane material. Monel is quite resistant to hydrofluoric acid under the conditions in which it is used in refineries. It is probably the most useful of commercially available materials for contact with this acid. It is applicable to all parts of the equipment of the HF alkylation units as now constituted.

Phosphoric Acid

Stainless steel, 18% chromium-8% nickel-3% molybdenum, is probably the most resistant of readily available, commercial alloys against phosphoric acid.

A widespread use has been noted of Monel to line headers, manifolds and valves subject to a weak, aqueous solution of phosphoric acid generated during steaming the catalyst bed. The Monel takes on a copper tinge in some instances and then corrosion occurs at a very slow rate.

Solvents

The chlorinated solvents often break down to form a corrosive reagent. Monel is highly resistant to this reagent and also tends to prevent the breakdown. This metal is widely used to contact carbon tetrachloride in various industries.

Phenolic compounds, especially when contaminated with sulfur, rapidly attack carbon steel. The 18-8 stainless is used as liners and tubes to contact phenolic compounds and hydrocarbons at elevated temperatures (above 500° F.). Monel is highly resistant to the phenol group of solvents and to furfural, which is also extensively used in petroleum refining. Vessels clad with Monel, and in one case sprayed with this metal are used to store furfural.

Caustic Regeneration

Caustic regeneration has become of increasing importance in refineries. The tubes of the boiler suffer severe attack when made of steel; also, some parts of the vessel walls are attacked.

Monel tubes have made an excellent showing when used in the tubular boilers. Monel-clad steel or local cladding can be applied to walls of the vessels when attacked. This steel is indicated for tube sheets of the reboilers.

General Corrosion

For general refinery corrosion such as experienced in handling reflux and treating of light fractions, also in handling corrosive waters, the alloyed cast iron Ni-Resist (14% nickel-7% copper) is most useful. It will be found applicable as pump parts, such as liners, pistons, valve parts, also as impellers and casings. K-Monel is suggested as the pump rods and shafts. Monel valves have done excellent service in pumps handling corrosive stocks at temperatures below 500° F.

Production Division

The production division has many problems peculiar to the drilling for petroleum and subsequent raising it to the surface.

Corrosion fatigue of drill pipe has been noted in many quarters. An effort to offset this difficulty was put forth, prior to the war, by a prominent western oil company by using an alloyed drill pipe. A composition of alloy by the trade name Yoloy was employed. This alloy steel contained approximately 2% nickel, 1% copper. Its mechanical properties exceeded those specified for Grade D drill pipe. The performance of the Yoloy pipe was reported as excellent and apparently more than justified expectations from a standpoint of resisting corrosion fatigue, abrasion and the complicated forces acting upon a drill pipe.

Abrasion is always a problem associated with production. Nickel containing alloys, such as the colomonoy group with nickel bases, and the well known lining materials containing nickel and boron, find applicatioin in connection witih mud handling.

The various types of Monel are used in connection with pumping and have long been used in gas lift equipment.

Ni-Resist cast iron has demonstrated a high order of resistance to the salt water associated with petroleum production. It has long been used in pumps handling brine and contaminated salt water. The use involves liners, pistons, impellers and valve parts. Shafts, rods and valve parts are made of Monel because of its well established resistance to salt waters.

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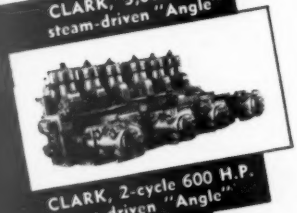

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The Stability of Butadiene*

More Detailed Information Concerning Chemical Reactions in Storage and Handling Revealed

Reactions which butadiene undergoes during storage and plant processing have been studied. The two reactions of most interest are: (1) dimerization by a Diels-Alder type condensation and (2) polymerization to plastic materials of high molecular weight. The first reaction is bimolecular and homogeneous in the liquid phase under a variety of conditions. Bimolecular reaction rate constants have been determined for a range of temperatures and compared with the constants for the gas phase reaction. The magnitudes of these constants are quite close. The formation of higher-molecular-weight polymers is peroxide-catalyzed. For a number of peroxide catalysts the rate of polymerization to plastic substances is proportional to the square root of the peroxide concentration.

*By Richard F. Robey, Herbert K. Wiese and Charles E. Morrell***

THE urgency for the expansion of synthetic rubber production involves a number of problems, not the least of which are the storage and handling of the hydrocarbon raw materials. Although butadiene is known to possess a certain degree of instability, the goal of this investigation was to obtain more detailed insight into the chemical reactions occurring during storage and handling. This information will permit a more intelligent selection of the conditions under which the diolefin can be handled or stored safely and with a minimum loss of valuable material.

From a broad point of view, butadiene can be considered unstable from two aspects: (*a*) With respect to its elements; that is, butadiene reverts to its elements, carbon and hydrogen, under an effective impulse and appropriate conditions, and results in the evolution of considerable heat:

$C_4H_6 \longrightarrow 4C + 3H_2 +$ approx. 27,000 cal.

At least one report (4) states that this reversion apparently took place under high hydrostatic pressure.

(*b*) Polymers are also formed with the evolution of heat:

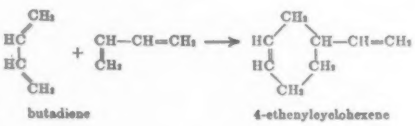
$nC_4H_6 \longrightarrow (C_4H_6)_n +$ approx. n 19,000 cal.

Thus the lower conjugated dienes, in general, can be considered as compounds existing at a high level of chemical energy with a tendency to drop to lower levels, on the one hand, by decomposition to elements and, on the other, by polymerization. Under conditions affording poor dissipation of heat, these reactions can produce high localized temperatures and thus spontaneously proceed with extreme rapidity, since they have positive temperature coefficients.

Another type of instability results when the diolefin reacts with other available substances, such as oxygen of the air, to form peroxides which are per se unstable. However, polymerization is the most important degradation reaction likely to be encountered in storage and handling, and hence considerable emphasis is placed on it in this discussion.

For years it has been known that butadiene and homologous conjugated diolefins undergo spontaneous polymerization to liquid polymers even at ordinary tmeperatures. Higher temperatures are known to result in the formation of relatively larger quantities of the polymer. Occasionally the formation of plastic rubbery polymers has been noted. In the latter cases some substances known to act as polymerization catalyst—e.g., peroxides or active metal—were generally known to be present. It has thus become clear in recent times that butadiene is capable of at least two types of polymerization which may occur separately or concurrently depending on conditions:

1. Cyclic polymerization or thermal dimerization results when two molecules of butadiene unite to form a ring type compound by Diels-Alder condensation:



The resulting dimer of butadiene is a stable liquid boiling at 127° C. and possessing a characteristic odor. It is miscible with butadiene in all proportions at ordinary temperatures and does not tend to undergo further polymerization to any major extent, although a slow trimerization reaction (combination of one molecule of dimer and one of monomer) has been noted (1).

2. Chain polymerization results in the formation of high-molecular-weight hydrocarbon material varying in consistency from a tacky fluid to a rubbery mass, and in certain instances to a resinous solid, depending on conditions. It is generally believed that this type of polymer results form the union of butadiene molecules in long chains, such as:

$$n CH_2=CH-CH=CH_2 \longrightarrow$$
$$\ldots -CH_2-CH=CH-CH_2-CH_2-CH=CH-CH_2-\ldots$$

There is evidence that some butadiene molecules are included in the chain by 1, 2 addition whereby unsaturated branches are produced.

The higher-molecular-weight polymers of this type are sometimes insoluble and tend to separate from the liquid monomer. It is believed that resinous properties and insolubility result from cross linking between polymer chains.

In the present investigation an endeavor was made to study these two types of polymerization independently and to determine the effects of variables, such as temperature, catalysts, extent of surface, and type of surface.

Thermal Polymerization

The rate of conversion of butadiene and other conjugated dienes to their respective dimers was studied in the gas phase by Kistiakowsky and co-workers (1). A brief study of the rate in the liquid phase was made by Lebedev *et al.* (2), but only at somewhat elevated temperatures. No systematic investigation under commercial storage, handling, and distillation conditions has been made to the authors' knowledge.

Several experiments were carried out in which liquid butadiene was sealed in tubes of steel or glass and maintained at a given temperature for a known length of time. Ultimately the tubes were opened and analyzed for the presence of polymer. The results of some of these experiments are presented in Table I.

The tests in steel bombs were made on freshly distilled (in a fifty-plate Stedman column), 97-99 per cent pure diolefin derived from the cracking of petroleum. The main impurity was 1-butene. The α-acetylene content was not more than 0.05-0.1 per cent. Although care was taken to exclude air while filling the steel bombs, some contact occured during the distillation. Extreme precautions to eliminate oxygen were taken with the samples sealed in glass. Materials were handled under vacuum or in a sealed glass system filled with deoxygenated nitrogen. The technique was similar to that of Medvedev *et al.* (3) in their recent study of the polymerization of chloroprene. The apparatus used for filling the glass ampoules consisted of a small column from which a sample in contact with pyrogallol was distilled into a flask connected to a reflux condenser. Here the sample was allowed to reflux for about 30 minutes before it was drawn into the evacuated ampoule. The sample was then frozen with liquid nitrogen and the ampoule sealed with a torch. The sealed ampoule was placed in a constant-temperature bath for a definite time.

Polymer was determined in the sample, after removal from the bath, by opening the ampoule, allowing the un-

* Presented before the Division of Petroleum Chemistry, at the 105th meeting of the American Chemical Society, Detroit, April 14-15, 1943.

** Esso Laboratories, Standard Oil Development Co., Elizabeth, N. J.

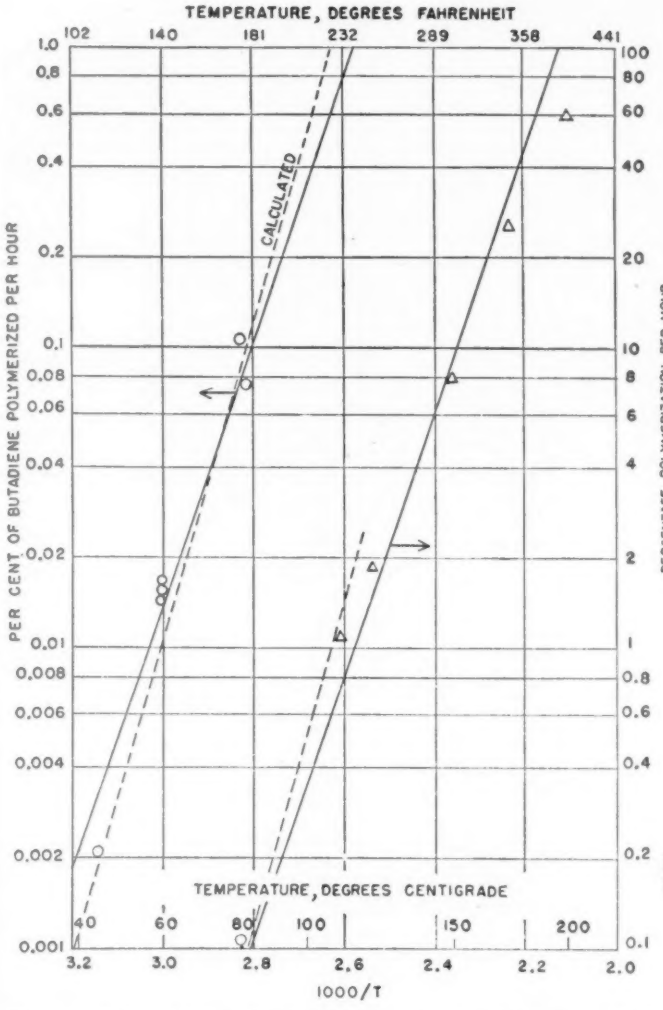


Fig. 1—Rate of dimerization of pure butadiene in liquid phase as a function of temperature. Circle indicates this investigation; triangle indicates Lebedev et al. (2)

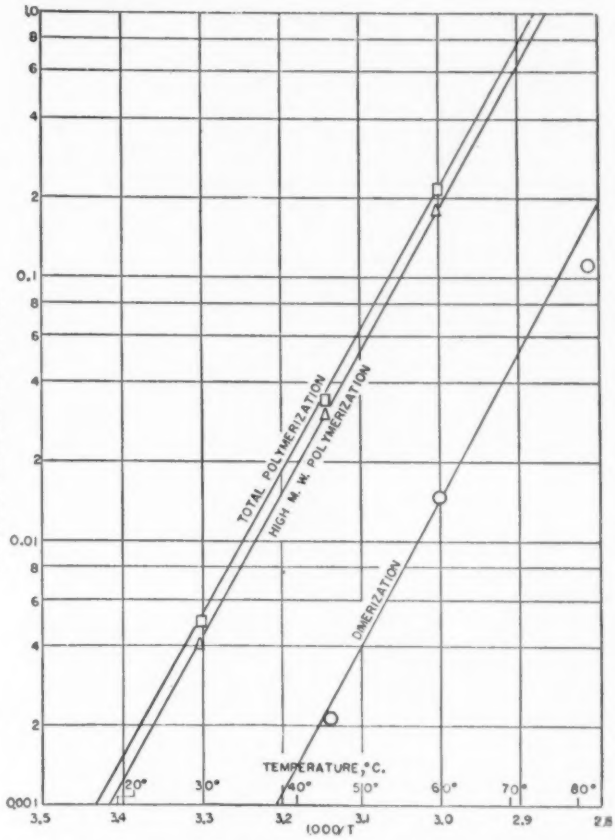


Fig. 3—Rates of conversion of pure butadiene to dimer and to chain polymer as a function of temperature (1200 p.p.m. active oxygen present)

reacted butadiene to boil off under room conditions, and weighing the polymer left behind. In some cases precipitated solid polymer was separated first. To make certain that no dimer was carried over with the vapors, the butadiene was recondensed and distilled in a small fractionating column in the presence of a small amount of added isooctane to act as carrier. The amount of dimer could then be determined by the refractive index of the isooctane-dimer mixture left as the residue in the fractionating column. No appreciable amount of dimer was found in this portion. In most of the experiments dimer was produced in too small a quantity to allow satisfactory characterization. However, in experiments where conversion was permitted to proceed to considerable percentages, a product was formed at least 95 per cent of which distilled at 127° C.

A number of important conclusions can be drawn from Table I. For example, the temperature coefficient of the polymerization reaction is quite high (Fig. 1). The plotted points fall nearly on a straight line, and the lower portion of this line is practically identical with a calculated curve. This curve was obtained by substituting liquid-phase concentration in the equation of Kistiakowsky *et al.* (1) for the vapor-phase dimerization reaction. The dimerization of butadiene in the vapor phase is a rather clean-cut bimolecular reaction, the rate of which can be expressed by the equation:

$$\text{rate (moles cc.}^{-1}\text{ sec.}^{-1} = 9.20 \times 10^{9} \exp.\ (-23{,}690/RT)\ [C_4H_6]^2$$

Barring the first run in Table I, the amount of solid polymer produced was insignificant, and the remarkable agreement between the observed rates of dimerization (liquid polymer formation) and those calculated by substitution of liquid-phase concentrations in the equation can be seen in the last two columns. The calculated rates of dimerization in the vapor phase under these conditions are negligible.

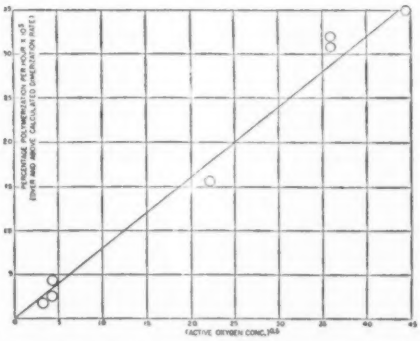


Fig. 2—Rate of formation of high-molecular-weight polymer in pure butadiene as a function of active oxygen concentration at 45° C.

Deviation of the experimental data from the calculated curve in Fig. 1 is greater at higher temperatures. This is probably due to the greater conversions to which the reactions were permitted to proceed in Lebedev's work. Adherence to a linear plot of log rate against $1/T$ in Fig. 1 would be expected only when the concentration of monomer remains virtually constant. Deviation is therefore observed as appreciable amounts of polymer product dilute the monomer.

A further point of interest is that the data for runs in various types of vessels fall on the same curve, indicating that the types of surface studied have no pronounced catalytic influence on the dimerization reaction.

Actually, the dimerization reaction was not the only type of polymerization in some of the runs. In experiments 1 to 4 (Table I) various amounts of a solid (rubbery) polymer were also obtained. However, the separation between the solid and liquid could not be made strictly quantitative because of the gel-

like form of the solid; consequently the apparent proportion of solid polymer is probably somewhat high. In experiments 1 and 3, and 2 and 4, tests were made both in the absence and in the presence of the antioxidant, hydroquinone, at two different temperatures. Butadiene from the same distillation was used in these comparisons. Even casual inspection of the resulting data reveals that the presence of the antioxidant inhibits the formation of plastic polymer but has no appreciable effect on the rate of formation of dimer. In fact, so far as the authors know, no way has as yet been found for minimizing the dimerization reaction in concentrated butadiene other than the use of the lowest practical storage and handling temperatures.

It is not possible to state definitely at this time that the truly thermal reaction does not give rise to some plastic polymer, although it is certain that such material is produced only in very small amounts. This uncertainty is due to the difficulty in experimentally removing the last traces of peroxides from a test sample and hence in completely eliminating the second type of reaction discussed below.

Polymerization in Presence of Peroxides

The second type of polymerization reaction occurring in butadiene is purely peroxide-catalyzed and is superimposed additively on the thermal reaction. The peroxide-catalyzed reaction produces largely the high-molecular-weight plastic type of polymer. Results so far available do not exclude the possibility of some dimer-like polymers also being formed in the peroxide-catalyzed reaction. Peroxide catalysts of different types were studied—benzoyl peroxide, Tetralin peroxide, and peroxidized butadiene.

The results of these experiments are summarized in Table II. It is apparent that the presence of peroxide does increase the rate of polymerization of butadiene at each of the temperature levels studied. Also, with the exception of experiments 25 to 28 which will be discussed later, there is no notable difference in the effects of benzoyl peroxide and Tetralin peroxide at 45° C. although a slight difference may exist at 60° C. Experiments 29 to 32, inclusive, made with the peroxide formed in butadiene on contact with air, showed considerably less activity.

The data in Table II indicate that the rate of formation of plastic polymer is very sensitive to small amounts of active oxygen (one active oxygen atom per molecule of peroxide), but the effect becomes less pronounced as the concentration is increased. More particularly it appears that the rate of formation of high-molecular-weight polymers varies directly as the square root of the concentration of active oxygen. This is shown by a plot of the data at 45° C. in Fig. 2. The square root relation has been noted in many other polymerization reactions catalyzed by peroxides. This effect is in accord with the free radical concept of polymerization catalysis.

The polymer (including dimer) in all experiments was soluble in the monomer, with the possible exception of the runs in which no peroxide was added; in these some precipitation was observed.

Runs 25-28 (Table II) were made in the presence of peroxides and increased surface; in runs 25 and 26 several pieces of mild steel were present, and in runs 27 and 28 glass beads were added. This increase of surface had no effect on the rate of polymerization in the presence of Tetralin peroxide, but the rate in the presence of benzoyl peroxide was decreased about 80 per cent. This may be due to deactivation or recombination of free radicals on the surface.

The effect of temperature on the rate of polymerization of butadiene in the presence of peroxides is shown by the conventional plot in Fig. 3. The curve for the rate of dimerization in Fig. 1 is shown along with the curves for the rate of polymerization to high-molecular-weight polymer in the presence of 1200 p.p.m. of active oxygen and also total polymerization (dimer plus high-molecular-weight polymer). It can be seen that in the presence of this concentration of active oxygen the dimerization reaction furnishes only about 10 per cent of the total polymer. The fact that all the curves have nearly the same slope indicates that the energies of activation of chain and cyclic polymerization of butadiene are practically identical.

A complete summary of the data obtained is presented in conveniently usable form in Fig. 4. The data obtained in the absence of any significant amount of peroxides are plotted along the ordinate at 1 p.p.m. active oxygen, and they appear to fall quite well on the extrapolated curves for each temperature. Plotting these data at 1 p.p.m. may be justified on the grounds that this is about the minimum concentration which can be maintained with certainty

TABLE I—Thermal Polymerization of Butadiene

Expt. No.	—Temperature— ° C.	° F.	Compn. of Sample	% Hydroquinone Added	Time, Hr.	Wt. % -Polymerized- Solid	Liquid	% Polymerized ———per Hr.——— Found	Calcd.
			Mild Steel Reaction Tubes						
1	82	180	Pure C_4H_6	None	93	3.8	6.7	0.112	0.15
2	82	180	Same	0.05	93	0.2	6.8	0.075	0.15
3	60	140	Same	None	168	0.5	2.0	0.015	0.014
4	60	140	Same	0.05	168	0.2	1.9	0.013	0.014
5	121	250	25% C_4H_6, 54% n-C_4H_8, 19% iso-C_4H_8	None	0.5	0.66		1.32	0.85
6	121	250	Same	None	1.0	0.71		0.71	0.85
7	121	250	Same	None	1.5	1.01		0.67	0.85
			Glass Reaction Tubes						
8	60	140	Pure C_4H_6	None	162.5	2.43		0.016	0.014
9	45	113	Same	None	790	1.72		0.0022	0.0025
10	30	86	Same	None	41.5	0.03		0.0007	0.0004

TABLE II—Polymerization of Butadiene in Presence of Peroxides**

Expt. No.	—Temperature— ° C.	° F.	Peroxide Added	Active O, P.P.M.	Time, Hrs.	Wt. % Polymerized	% Polymerized per Hr.
10	30	86	None	0	41.5	0.03	0.0007
11			Benzoyl	13	19.5	0.015	0.0008
12			Benzoyl	330	19.5	0.11	0.0056
13			Benzoyl	1275	20.5	0.10	0.0049
9	45	113	None	0	790	1.72	0.0022
14			Benzoyl	13	24	0.118	0.0049
15			Benzoyl	13	788	4.38	0.0055
16			Tetralin	20	788	5.29	0.0067
17			Benzoyl	500	24	0.432	0.0180
18			Benzoyl	1275	24	0.81	0.034
19			Benzoyl	1290	783	26.98	0.0342
20			Tetralin	2000	788	30.0	0.0381
8	60	140	None	0	162.5	2.43	0.016
21			Benzoyl	13	162.5	4.89	0.030
22			Tetralin	20	162.5	4.21	0.026
23			Benzoyl	1155	162.5	34.49	0.212
24			Tetralin	2000	162.5	25.52	0.157
25			Benzoyl°	1290	162.5	8.32	0.0512
26			Tetralin°	2000	162.5	26.83	0.165
27			Benzoyl†	1290	162.5	10.68	0.0657
28			Tetralin†	2000	162.5	27.91	0.172
29	45	113	Peroxidation by air	49‡	720	2.70	0.0038
30			Same	193‡	720	5.75	0.0079
31	60	140	Same	60‡	264	6.4	0.024
32			Same	171‡	264	8.1	0.031

**98-99% butadiene in sealed glass tubes.
°In presence of steel strips.
†In presence of glass beads.
‡Determined by the ferrous thiocyanate colorimetric method (5).

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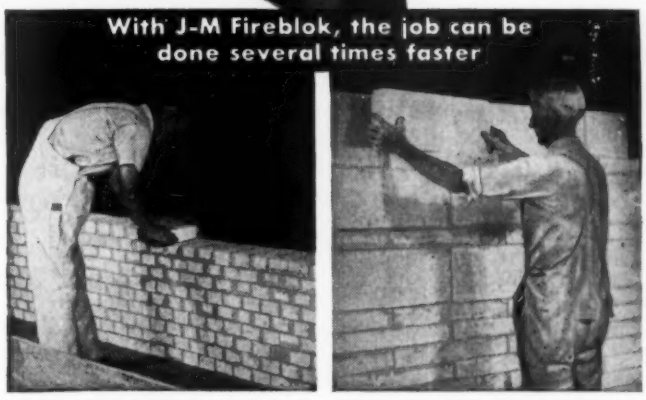

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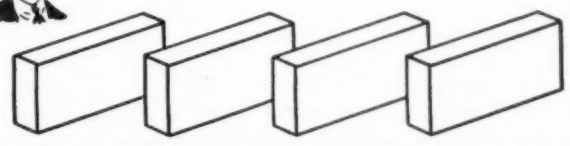

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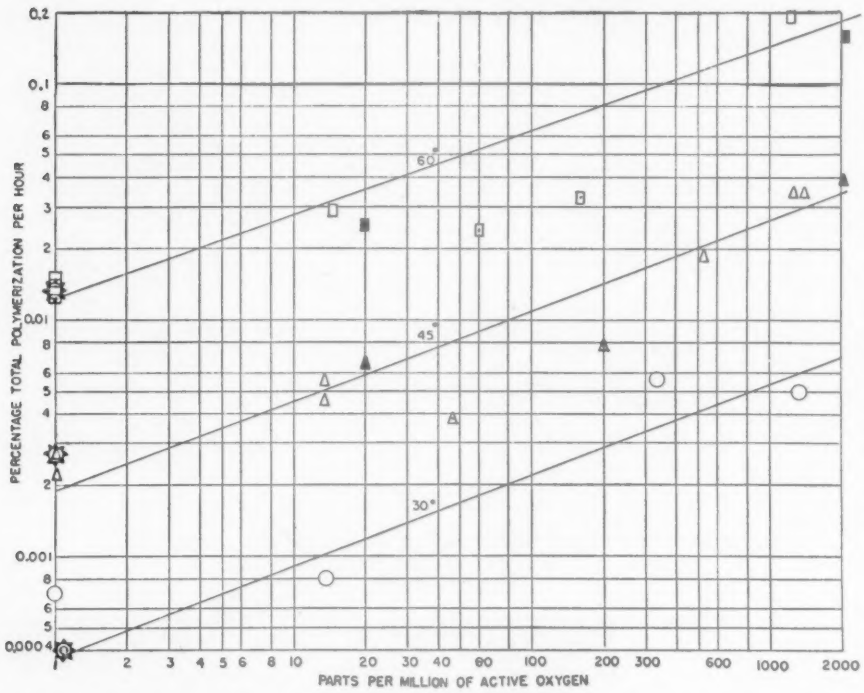

Fig. 4—Rate of polymerization of pure butadiene as a function of active oxygen concentration at various temperatures. Plain square, triangle and circle indicate benzoyl peroxide; blackened square and triangle indicate tetralin peroxide; dotted square and triangle indicate butadiene peroxide. Starred points at extreme left are calculated from dimerization rate equation

in butadiene, even with the most careful technique.

The data of runs 2 and 4 (Table I) demonstrate that the peroxide-catalyzed reaction can be effectively subdued by the proper use of polymerization inhibitors. It should be emphasized, however, that no inhibitor can be expected to last indefinitely. For this reason, the periodic checking of the inhibitor content of stored butadiene appears desirable, especially under conditions affording exposure to air.

Peroxidation of Butadiene

Since it has been shown that the presence of peroxides has considerable influence on the rate of polymerization, it is important to know whether butadiene will peroxidize in contact with oxygen, air, or other oxidizing substances. This has been answered in the affirmative.

Experiments were made in which freshly distilled butadiene was kept saturated with air at room temperature and at 50° C. under pressure. These showed active oxygen concentrations of 120 and 460 p.p.m. after 48 and 24 hours, respectively. When 25 ml. of the peroxidized butadiene obtained at the end of the room temperature run were permitted to evaporate to dryness under room conditions, 0.11 gram of an oily substance, having a sharp aldehydic odor and an active oxygen content of 18,000 p.p.m., remained as residue.

Compounds, such as hydroquinone, pyrogallol, catechol, etc., are quite effective as inhibitors of the peroxidation of the diene. For example, 300 cc. of butadiene containing 0.1 weight per cent of hydroquinone completely resists the peroxidizing action of a stream of air, at room temperature and 50 pounds per square inch pressure, for more than 120 hours.

Instability in Distillation

From the foregoing the extent of polymerization at the elevated temperatures of distillation can be predicted with considerable certainty. However, a more hazardous form of instability may be encountered. As pointed out above, there is a tendency for peroxides to accumulate as "bottoms". Distillation in batch to low bottoms, for example, may result in active oxygen concentrations in the residue so high that further heating produces an explosive autoxidation. The danger involved in distilling peroxidized butadiene to very low bottoms is emphasized by the following experiment: The peroxidized butadiene produced in the 50° C. test was permitted to evaporate under room conditions. After all of the liquid hydrocarbon had disappeared from the flask and only a residue remained, the vessel was covered lightly and heated on a sand bath so that the temperature rose at the rate of 10° to 12° C. per minute. When 125° C. was reached, violent decomposition took place within the flask, the cover of the flask was displaced, and large volumes of white fumes were evolved. Further heating to 250° C. resulted only in the charring of the trace of residual material.

Experience indicates that the explosion hazard may be eliminated by distilling in the presence of an adequate amount of peroxide-destroying substance and preventing air from returning to the distillation vessel after the heat is removed. In the case of batch distillation of butadiene-containing materials of high peroxide content, it is desirable that the peroxides be destroyed by the antioxidant before distillation is started. Since most peroxides require appreciable time for decomposition by antioxidants, the elimination can be conveniently effected by heating under pressure until the absence of peroxides is indicated by chemical test. In distillation the addition of a hydrocarbon boiling higher than butadiene is an added factor of safety since such a procedure limits the degree to which the peroxides can be concentrated during a single distillation.

Summary

1. The most prominent polymerization of pure butadiene in the absence of peroxides is dimerization. This reaction is thermally activated and does not appear to be catalyzed by peroxides or by steel surfaces.

2. Butadiene is also capable of independent polymerization to high-molecular weight polymer, but in the absence of peroxides this reaction is insignificant compared to dimerization. The effect of temperature on the rates of each of these reactions has been determined.

3. In the presence of appreciable amounts of peroxides, polymerization to high-molecular-weight polymer becomes prominent and is superimposed additively on the thermal dimerization reaction.

4. The addition of suitable antioxidant inhibits the formation of high-molecular-weight polymer but has no appreciable effect on the rate of dimer formation.

5. The rate of high-molecular-weight polymerization is directly proportional to the square root of the concentration of peroxides (active oxygen).

6. Butadiene is readily peroxidized by air, but this peroxidation may be inhibited for a time by the presence of antioxidants.

7. The peroxides are not readily volatile and tend to accumulate in the residue if the diene is evaporated or distilled away. Concentration beyond a certain point yields an unstable residue which may decompose with violence when heated. Precautions for distillation of such peroxidized material are given.

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Centralized Control is Feature Of Refinery Protective System

A centralized control system, invaluable in any peacetime emergency, as well as in the war emergency, is a feature of the plant protective system developed at the Baton Rouge refinery of Standard Oil Co. of Louisiana, described in the accompanying article. This plant was one of 28 in the country which were given awards by the Office of Civilian Defense for outstanding wartime plant protection programs.

The Norco refinery of Shell Oil Co., Inc. was the only other petroleum refinery receiving one of these awards. Its plant protection system was described in the May 3d Technical Section of National Petroleum News.

AS POINTED OUT by Maj. Fred Kreissl, industrial plant protection officer for the Eighth Civilian Defense region, Dallas, at a recent ceremony at which the Baton Rouge refinery of Standard Oil Co. of Louisiana was presented with the National Security award, the maintenance of plant efficiency concerns everyone, particularly in wartime. "There is little likelihood of an air attack today," said Maj. Kreissl, "but continued vigilance is required against other threats to plant efficiency and production if a plant is to do its best in the war effort."

Maj. Kreissl spoke highly of the Baton Rouge plant's centralized control system —something relatively new in plant protection measures, he said—and prophesied that this system would continue in use in peacetime as it has so successfully during the present emergency, since it is useful in co-ordinating the activities of police, fire, medical, operations, and any other facilities which are or may be established for the preservation of life and equipment at the refinery.

R. E. Smith, regional director of the Eighth Civilian Defense region, made the award presentation in behalf of the national Office of Civilian Defense.

Because the Standard Oil's refinery and chemical products division are in separate enclosures, with a public thoroughfare dividing the properties, the plant emergency organization found it expeditious to set up its procedures for passive defense accordingly, dividing the whole of the areas into warden districts, a shift foreman in each district serving as the warden on his shift. In addition, under the refinery's setup, the shift fire marshal was made to serve as the fire warden, the shift roundsman as police warden, and the shift hospital attendant as medical warden.

Has Emergency Co-ordinator

Under the refinery's plant protection system the various wardens, in case of emergency, fall under the direction of the shift superintendent who may be on duty at the time. This superintendent is called the emergency co-ordinator. His office is at a control center located within the refinery and is known as the office of the emergency co-ordinator (O.E.C.). This center is equipped with telephone communications to each of the various warden districts situated in the refinery and chemical products areas, which hereinafter will be referred to as one area.

The control center also has a private telephone line which is connected with the telephone system in the city of Baton Rouge. It is over this line that Army air raid signals—should there be any —will be received.

Telephone lines to the district wardens are not listed in the refinery's telephone book, for these lines are devoted exclusively to communications with the emergency co-ordinator's office, at which there are control buttons for sounding all warning signals, including the air raid alarm.

To summon the district wardens, a certain signal sounded on the refinery's work whistle is sufficient. The wardens hearing their signal call into the O.E.C. at once, using their unlisted telephones. By means of this system, the reporting of emergencies to the district wardens can be handled quickly and confidentially, thus eliminating any likelihood of confusion among the refinery personnel who are not immediately concerned.

In addition to the emergency co-ordinator, the O.E.C. is manned on a continuous three-shift basis by office guards who function in emergencies under the direct supervision of the emergency co-ordinator in charge. The entire procedure is planned so that an emergency can be handled with whatever manpower may be on duty at the time. This does not mean, however, that additional assistance will not be called; for it is provided that, except in case of a blackout, when it is not desirable to have any mass movement of employes, additional help will be sent for when and if needed.

Equipped for Blackout

The refinery area is excellently equipped for complete blackouts, despite the obvious difficulties which had to be overcome to make this possible. Nine test blackouts have been conducted thus far, one of them being completely unannounced. On each test the entire area was in total darkness, except for authorized lights in light-trapped buildings, within less than one and a half minutes. Air raid signals from the Third Fighter command can be received by the O.E.C. through the control center for East Baton

At the presentation of the National Security Award to Baton Rouge refinery of Standard Oil Co. of Louisiana. Left to right: R. G. Dobyns, Maj. Kreissl, W. P. Reymond, jr., F. P. Hagaman, H. J. Voorhies, Brig. T. F. Porter, R. J. Stone, J. I. Smith, Mayor Fred S. LeBlanc, R. E. Smith, M. J. Rathbone, C. A. Ives, Lt. C. S. Roby, M. J. Fruge, Lt. L. E. Steele

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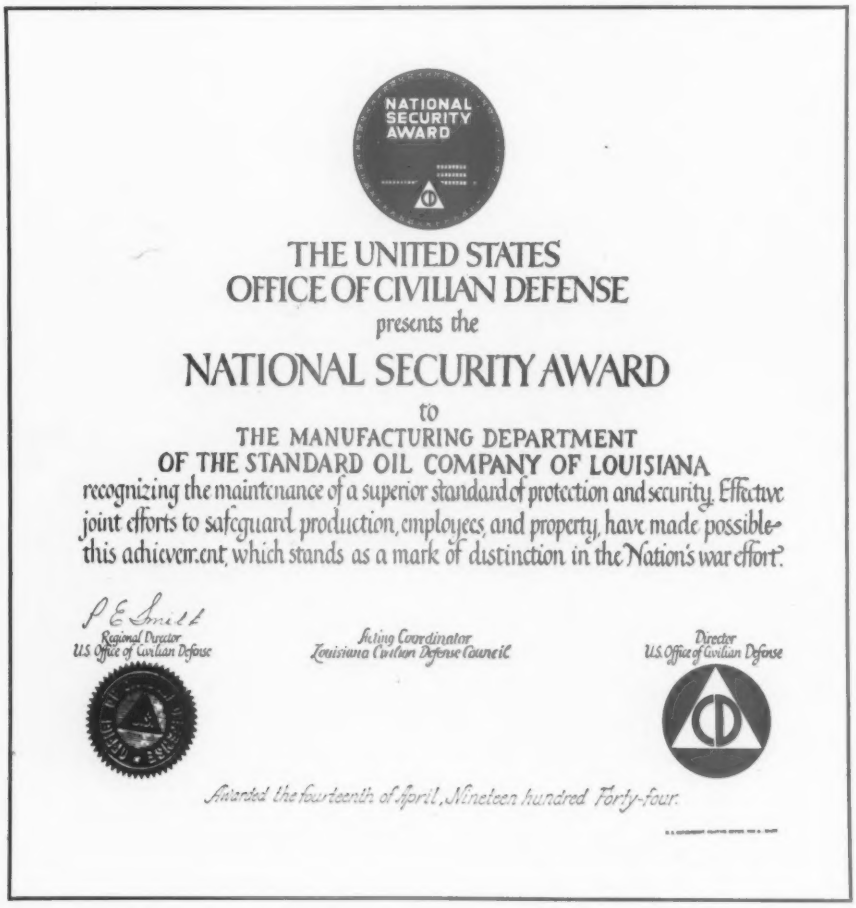
NATIONAL SECURITY AWARD
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recognizing the maintenance of a superior standard of protection and security. Effective joint efforts to safeguard production, employees, and property, have made possible this achievement, which stands as a mark of distinction in the Nation's war effort.
P. E. Smith
Regional Director
U.S. Office of Civilian Defense
Acting Coordinator
Louisiana Civilian Defense Council
Director
U.S. Office of Civilian Defense
Awarded the fourteenth of April, Nineteen hundred Forty-four.

Rouge Parish. Such signals are handled over a secret telephone, the number of which is known only to persons on duty at this main center. Preliminary warnings are disseminated by means of the warden call system, while the mobilization signal is sounded on the air raid sirens controlled by the emergency co-ordinator.

The Standard Oil organization has found from experience that training of personnel through personal contact is much more effective than training through the use of pamphlets, memoranda, etc. Foremen conferences and other employe gatherings are largely used to bring to the attention of plant personnel the importance of everyone doing his part in the protection of the plant. An effort is made to insure the latest information on the subject being given the workers, either by word of mouth or in the refinery's publication *The Stanocolan*, explanations being made of the different phases of plant protection procedures and the full support of all workers urged in the enforcement of plant protection rules and regulations. Each new employe is given a copy of extracts from the U. S. Espionage Act and Sabotage Statute, and caution is made against revealing to outsiders information about plant activities or other matters which might possibly give aid to the enemy.

A first aid training program is almost constant at the Standard Oil refinery. New employes are given a 15-hour course of instruction in first aid under the supervision of the U. S. Bureau of Mines, and review courses on the subject are conducted annually for those who have previously completed such training. As a result of this program, which has been in operation for more than 20 years now, the greater part of the plant personnel is well trained in first-aid.

Aid Stations Maintained

Two fully-equipped first aid stations are maintained at the plant, with two full-time physicians, five nurses, and a staff of competent first aid assistants active or available. An ambulance is permanently assigned to one of these stations, and cots are located throughout the operating area which can be loaded on trucks in the event multiple injuries require additional ambulance service.

Safety training is also a continuous program at the refinery and is made an integral part of the apprentice training program in several crafts.

A knowledge of the most up-to-date methods of fire-fighting is requisite here also, and it is the refinery's practice to give 15-hour training in the technique of fire-fighting to selected employes. This includes actual drills in the handling of fire-fighting equipment. In addition to this specialized training, a continuous program of education for operating supervisors and their assistants has been devised to keep them abreast of the latest and best methods of fighting fire.

Every person who enters the plant area must be identified. The employes themselves wear metal badges displaying their photographs and payroll numbers, and each one is identified at the plant entrance before he may enter.

Contractors, contractors' employes and visitors having business on the premises are equipped with a type of badge that is different from that of regular employes, who, like the refinery police, are alert to challenge anyone who might be found in the area without a visible means of identification.

The plant's police department is an organized auxiliary of the military police and has been trained by an officer of the Eighth Service Command. All guards are uniformed and carry side-arms. In addition to the guards' military training, they are given instructions by the refinery's own training department and by the local chief of police concerning their responsibilities, conduct requirements, and duties at each guard post.

Coast Guard 'on Alert'

Along the Mississippi River, which marks one of the boundaries of the plant area, the U. S. Coast Guards are ever "on the alert." They patrol the river front continuously and exercise guard supervision over all river front activities, assisted at the plant by guards assigned to the dock area. No visitor to the river front goes there without being identified to the complete satisfaction of both the guards at the main gate and the individual he desires to see. Once consent to visit the plant is obtained, the visitor must not only sign a visitor's agreement card, which has provisions for the declaration of citizenship, but also he must move under escort at all times while he is on the plant premises. The agreement cards, incidentally, are kept available "for future reference".

Finally, a full-time fire department is maintained here. This department is under a chief fire marshal with an assistant fire marshal in charge of each shift. Along with its other duties, the fire department is charged with the responsibility of inspecting and maintaining the low and high-pressure water systems throughout the area, the steam lines, foam equipment and the portable fire extinguishers.

The fire-fighting equipment at the Baton Rouge refinery is somewhat elaborate in that, along with its other extensive facilities for fire fighting, the plant has more than a hundred hose houses strategically located throughout its area, with some 10 miles of 2½-inch water hose and the necessary booster pumps, hydrants, etc. It has also a completely equipped fire truck containing a 500 gpm pumping unit.

As it was remarked by Regional Director Smith when he made the National Security award presentation to the Standard Oil refinery, "only the preparedness and vigilance shown at this refinery made possible the national recognition that is implied in the O.C.D. award".

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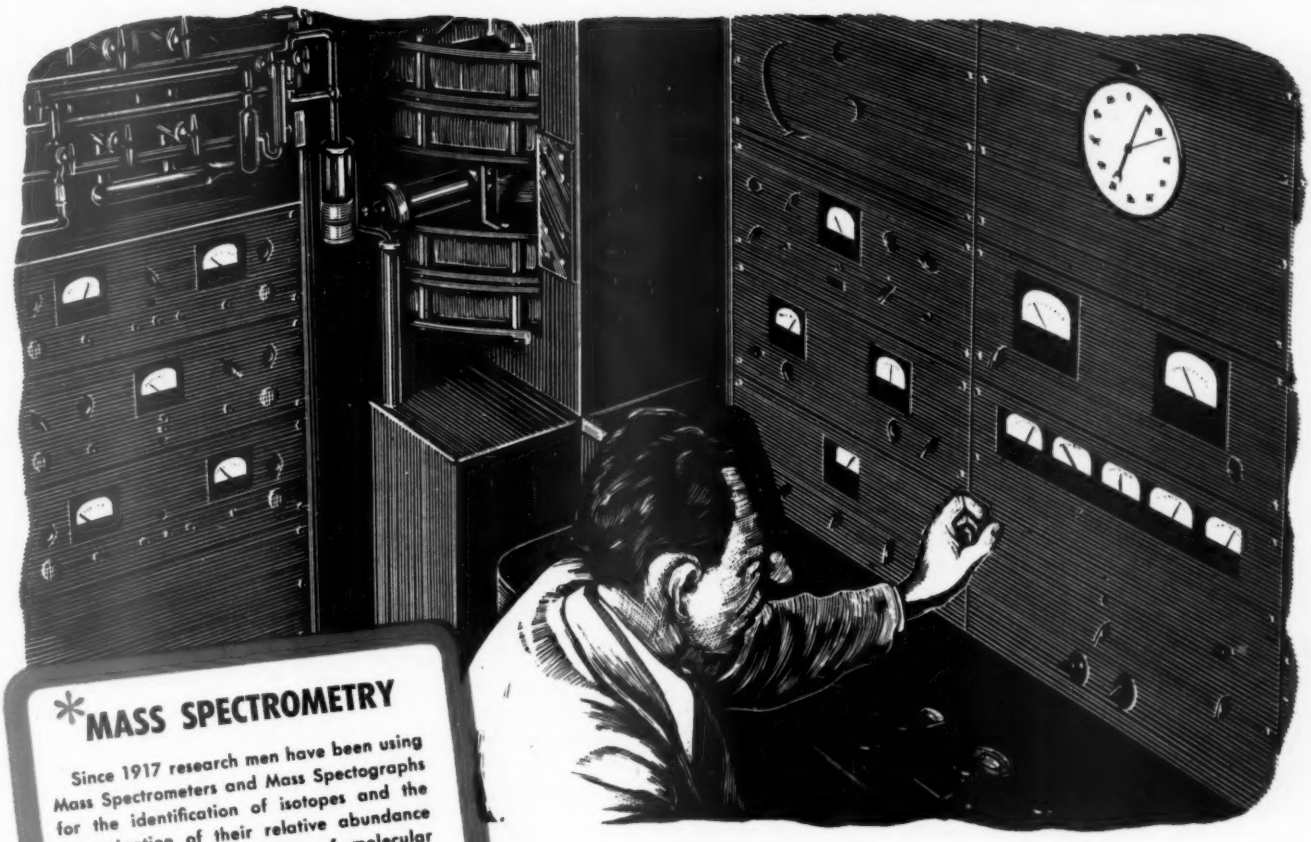

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It remained for Consolidated Engineering Corporation, however, to develop the first *Analytical Mass Spectrometer* designed for general industrial use. The research program of many years which culminated in the Consolidated Mass Spectrometer was carried on by a staff of experts noted for their work in similar fields and was aided in a large measure by the cooperative work of eminent physicists and engineers.

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THE Consolidated Mass Spectrometer is an electronic instrument for the *qualitative* and *quantitative* analysis of complex gaseous or liquid mixtures. Samples of 0.1 cc liquid or 10 cc gas including as many as fifteen components can be analyzed by this instrument with a remarkable degree of accuracy. Contrasted with the many hours and even days required for the accurate analysis of such mixtures by customary chemical methods, most samples are analyzed completely in a half hour to two hours by Mass Spectrometer technique.

Under war-time restrictions the mass spectrometer is now being applied specifically to the analysis of charge-stocks and feed streams in the manufacture of high octane aviation gasoline and synthetic rubber, providing a superior control that permits far more efficient plant operation. One user of the Consolidated Mass Spectrometer analyzed over 200 samples in two weeks, and reports that within six months sufficient savings were made in plant operation to pay for the instrument.

Unlimited possibilities for the development of new products and for the designing of more effective control techniques are available through the use of this new industrial tool.

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Herbert Hoover, Jr., President
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Alien Patents Available to U.S. Industry Cover Many Petroleum Refining Processes

Technical Advisory Committee of P.I.W.C. Reports Results of Investigation of Unfiled and Abandoned Applications

The Technical Advisory Committee of the Petroleum Industry War Council has completed a study of enemy alien patents and related material held by the U. S. Alien Property Custodian which are of value or interest to the petroleum industry.

Working in co-operation with the Custodian's office, a T.A.C. group of oil company technologists reviewed the classes of this material which previously had not been indexed and listed. These classes consist of abandoned patents controlled by enemy aliens and disclosures of inventions received from enemy countries. Those considered as being of value to oil companies have been translated, if this was required, and abstracted. The accompanying report includes the committee's complete abstracts for these two groups of enemy alien patents. Two other groups, those of issued patents and pending applications, it is pointed out, had already been published by the Custodian's office and data on these patents are available to oil companies through that government agency.

The report of the Technical Advisory Committee makes available to the entire oil industry data on the two groups of enemy alien patents which were not hitherto available. Much of the data pertains to new products and processes of value to refiners. The complete report appears below.

IN ACCORDANCE with the policy of the Alien Property Custodian that patents and related material vested in the Custodian be made available to the American people, the Custodian's Office requested cooperation of various government agencies in implementing this policy in the fields of interest to those agencies. Four classes of material were discussed by the Custodian's Office with the Petroleum Administration for War as representing information that might be of interest to the petroleum refineries. These are:

1)—Issued Patents

These are patents which, because of enemy alien ownership, have been vested in the Custodian. The Custodian has prepared lists of these patents in each U. S. Patent Office classification. These lists are available at a small fee to any one requesting them. It is the policy of the Alien Property Custodian to issue non-exclusive licenses under patents vested in him except where exclusive licenses to American citizens were already outstanding when the patents were seized.

2)—Pending Applications Controlled by Enemy Aliens

These have likewise been vested in the A.P.C. They have been listed according to their patent office classifications and the lists have been made available to anyone interested. The lists have now been published in the Patent Office Gazette. Specifications of most of these applications have been printed and may be purchased in the same way as copies of patents.

3)—Abandoned Applications Controlled By Enemy Aliens

4)—Disclosures of Inventions Received from Enemy Countries Reported or Submitted to the Custodian Under His General Order No. 12

These comprise material sent to the U. S. from enemy aliens but on which patent applications have not yet been filed.

After full consideration and discussion it was agreed that there might be considerable material of interest in the last two categories which are not available through then existing publications of the Custodian's Office.

The Refining Division of PAW, being unable with its limited personnel to make the necessary study of material made available by the Custodian, obtained the Custodian's consent to call in the industry group. The Technical Advisory Committee (a Subcommittee of the Technical Committee) of the Petroleum Industry War Council agreed to make such a group available on condition that material would be kept confidential by the individuals involved until the PAW and the APC agreed to its distribution.

The study group consisted of Louis D. Forward, Harold V. Atwell, and Myron J. Burkhard, representing, respectively, the Sinclair Refining Co., The Texas Co., and the Socony-Vacuum Oil Co., Inc., the member companies of the T.A.C. which made their services available. The group worked in close cooperation with A. E. Miller, secretary of the Technical Advisory Committee, and under the general guidance of Dr. T. G. Delbridge, chairman of the T.A.C.

The group's report has been presented to the Refining Division of PAW which has obtained the consent of the Alien Property Custodian to its publication in order that it may receive as wide circulation as possible among those interested in the field covered.

Report

Acting on behalf of the Technical Advisory Committee for the Petroleum Administration for War, the study group recently accepted the assignment of reviewing unfiled disclosures of inventions and abandoned patent applications seized by the Alien Property Custodian with the object of reporting to PAW its findings as to inventions or useful technical information of possible direct or indirect interest to the petroleum industry. It was the understanding of this group that secrecy would be maintained with respect to all subject matter covered in the course of this undertaking unless and until the information had been released to the petroleum industry generally. This policy has been maintained.

The study group started making this review on Dec. 8, 1943, and the review now has been completed with respect to unfiled disclosures and abandoned applications vested in the Alien Property Custodian as of Jan. 12, 1944. We understand that the material covered by this review includes all of the material in the previously identified categories seized by the Alien Property Custodian except for a few items not yet vested or which were otherwise not available for study. However, since vesting of the few remaining items may be delayed indefinitely, the study group presents herewith its report on the work now completed.

The staff of the office of the Alien Property Custodian has accomplished a major task in segregating, roughly classifying, and indexing the enormous number of unfiled disclosures and the very considerable number of abandoned applications now vested in the Alien Property Custodian. This materially reduced the expenditure of time and effort by the study group in the present specific undertaking. Moreover, the study group gratefully acknowledges the cooperation and courtesy of the staff of the Alien Property Custodian in extending the facilities of its offices for making this review and for the

prompt manner in which those files selected for review were made available. The substantial assistance of Donald G. Welsh of PAW, particularly in matters of preliminary screening and obtaining prompt access to those files selected for review, is also acknowledged.

Ground Covered by Study Group

Unfiled Disclosures: The very large number of unfiled disclosures vested in the Alien Property Custodian have been card-indexed by a title which is roughly descriptive of the subject matter involved. These were roughly screened by title to segregate those cases which probably would be of no interest to the petroleum industry. The discards were then rescreened by each member of the study group so that the group of cases selected for closer review would include all cases that in the opinion of any member of the study group might be of direct or indirect interest to the petroleum industry. All prior screenings were disregarded. In any instance where the identity of the subject matter appeared doubtful from the title, the file in such case would be included within the group of cases to be more closely reviewed. As a result of this very generous method of screening, many of the disclosures in the group of cases more completely reviewed were, on closer inspection, found to be of no conceivable interest to the petroleum industry. All unfiled disclosures which were reviewed in full, and regarded by any member of the study group as being of any possible direct or indirect interest to the petroleum industry, were either abstracted or translated and the abstracts of translations are reproduced in this report.

Some of the unfiled enemy disclosures were available in the form of substantially complete patent applications in the English language so that no problem of translation was involved. However, as to the major part of the unfiled disclosures, no English text was available. The study group had the assistance of Eugene C. Buck as translator. In a few instances it seemed more expedient to make a substantially complete translation rather than to attempt to prepare an abstract directly from the original foreign language disclosure. In these few instances the substantially complete translations are included in this report.

Each of the unfiled disclosures in the office of the Alien Property Custodian is identified by a TC number. Such of these disclosures as are referred to in this report have been identified by this TC number, and we have been advised that a copy of the complete disclosure will, on application to the APC, be made available for inspection in any instance where the information disclosed by the abstract appears to be of sufficient interest to warrant further investigation.

Abandoned Applications: As to the abandoned applications, these have been indexed in the office of the Alien Property Custodian in conformance with their Patent Office classification. The Patent Office classes covered by the study group were classes No. 44, No. 196, No. 202, No. 252, and No. 260. In this category the study group, as decided in conference with representatives of PAW and APC, confined its review to those cases which were abandoned during or subsequent to the year 1939. The same very liberal method of screening was employed here as in the case of unfiled disclosures. As a result of this very generous method of screening some of the abandoned applications were abstracted even where the application had been finally rejected and the rejection affirmed by the Patent Office Board of Appeals.

Complete Details

Further information on the patents abstracted in this report can be obtained by communicating with Howland H. Sargeant, Division of Patent Administration, Office of Alien Property Custodian, Washington 25, D. C. Regular patent reports do not appear to be available, but arrangements can be made to inspect the file of any patent. If that is impractical, photostatic copies of a file can be secured at 20 cents per page. Some files include drawings.

These patents are available under simple licensing terms. The $15 fee charged for licenses to use pending and abandoned applications has tentatively been set for licenses to use unfiled patent applications, according to Mr. Sargeant.

However, in those cases where an application had been finally rejected on cited art, or where the rejection had been affirmed by the Board of Appeals, this circumstance is indicated in the abstract. We are advised that the complete files of the vested abandoned applications of enemy origin are also available for inspection upon application to the APC.

Comment

In the case of a few of the abandoned applications, and also in the case of a few of the unfiled disclosures which were in complete application form, the nature of the disclosure was such that reproduction of a few of the claims appeared to be the most expedient form of abstract.

In view of the very generous method of screening employed, involving as it did the inclusion of subject matter regarded as of any possible direct or indirect interest to the petroleum industry by any member of the study group, care has been taken in all instances carefully to refrain from expressing in this report an opinion as to the novelty, merit or value of the subject matter involved. The abstracts and translations are presented herewith.

Unfiled Disclosures

TC 214—"Method for Obtaining Lubrifying Oils"—Pierre Laurent, France.

Amyl alcohol is catalytically dehydrated to amylenes — in vapor phase over phosphoric acid; amylenes are polymerized—in liquid phase with aluminum chloride; product is washed, neutralized, dechlorinated, and filtered to final product. Yield over 65% with respect to amyl alcohol used. Last two steps may be applied to other starting materials containing appropriate olefins.

TC 216—"Synthetic Lubricant"—Pierre Laurent, France.

Trixylenyl Phosphate, $[(CH_3)_2C_6H_3)O]$-PO, viscosity ±53 centistokes at 35°C., ±23 centistokes at 50°C., may be used as a lubricant, particularly in mixtures of ±95% of the phosphate and ±5% of an animal or vegetable oil, as olive oil.

TC 218—"Improvement in Method for the Manufacture of Saturated Products from Natural or Treated Oils"—Pierre Laurent, France.

An animal or vegetable oil containing double bonds is condensed with an aryl hydrocarbon in the presence of a Friedle-Craft catalyst to provide a saturated product which may be further modified, as by alkylation. Example: Benzene is alkylated, as with ethylchloride; the resultant alkyl benzene is condensed with the "natural" oil, as fish oil; and the product resulting, which usually contains excess alkyl benzene, may be further treated with a dichlorinated hydrocarbon.

TC 229 — Process for Obtaining Oils from Resins"—Pierre Laurent, France.

A rosin oil is treated with up to about 2% of 85% phosphoric acid at temperatures of 150 - 250°C. to decarboxylate, obtaining about 75% yield as oils, which may be treated with adsorptive earth in liquid phase to remove unsaturates, etc., producing oils of

Density 15°C.—0.969 - 0.970
Visc. at 35°C.—±30 Centistokes
Visc. at 50°C—10 - 20 Centistokes

TC 230—"Process for Treatment of Resins and Similar Substances"

Rosin oil treated with hydrogen at 300 - 500°C., partial pressure of hydrogen 20 kg/sqcm or above, catalyst as copper molybdenum, or nickel, etc., preferably with solvent such as pindene, to produce "mixture of cyclanic and aromatic products" useful as lubricants etc.

TC 241—"Improvements in the Manufacture of Aliphatic Amines"—Henry M. Guinot, Les Usines deMelle France.

Improvement on process for making aliphatic amines covered by U.S. 2053-193, according to which an alcohol is converted to nitrile by reaction with ammonia and the nitrile is hydrogenated to amine. The present invention covers making predominantly secondary or tertiary amines by recycling the primary amine to the step in which alcohol is converted to nitrile. For example ethyl alcohol is reacted with ammonia over

reduced copper at 320°C. and the resulting nitrile is hydrogenated at 160°C., the monoethylamine produced being recycled to the first stage.

TC 244 — "Improvement in Catalytic Polymerization Processes"—H. M. Guinot, France.

The cyclic ethers containing two oxygen atoms in the ring, and their derivatives, can be converted into peroxides very readily, and these peroxides are very good catalysts for promoting polymerization °° of diolefins °° (and) °° all compounds which polymerize to give gums or resins. Example: dioxanes or dioxolanes, as αα B'B' Tetramethyl dioxane, slowly oxidized, to form a solution of resulting peroxides, will promote the polymerizing of butadiene to a gum.

TC 245—"Improvement in the Hydration of Olefines to Form Alcohols"—H. M. Guinot, France.

"Solution and hydration of olefins in sulphuric acid takes place at high pressure" in one chamber, and in another "removal of the alcohol from the acid is effected at substantially atmospheric pressure". Examples—production of isopropanol, ethanol.

TC 256—"Process for the Fabrication of Oil"—Pierre Laurent, France.

Vegetable or mineral oils may be adjusted in viscosity by blending with phthalates, as ethyl phthalate.

TC 261—"Process for Polymerization"—Jean F. Joliot, France. (Corresponds to French application filed April 30, 1940.)

Large masses of polymerizable material, such as methyl methacrylate in a suitable mould are polymerized uniformly "in cold condition" by exposure to a "beam of rapid neutrons produced, for instance, by a source of 100 millicuries formed by radon mixed with beryllium powder". A cyclotron, or other source of neutrons, may also be used. Such polymerization is stated to avoid strains resulting from uneven polymerization when accomplished thermally and to give improved optical properties.

TC 296—"Bituminous Composition"—Robert Horn, Reutgerswerke Akt. Ges. Germany (Division of SN/245735 Filed December 14, 1938).

Covers the use of air blown petroleum asphalts or high melting petroleum asphalts made by vacuum reduction to give stable mixtures with coal tar, particularly coal tar of low anthracene oil content, over a wider range of proportions than would be possible with other petroleum asphalts.

TC 307—"Process for the Manufacture of Lubricating and Insulating Oil"—Pierre Laurent, France.

Colophony or rosin oil, is hydrogenated at 250-450°C., at hydrogen pressures of 100-1000 kg/sqcm with heavy metal catalysts as copper, tin, cobalt, nickel; to produce oily product useful for lubricants, dielectrics, etc.

TC 1053—Improvement in Fuels and Methods and Apparatus for Manufacturing the Same"—Eugene J. Drouilly, France.

In the operation of an internal combustion engine on ammonia as a fuel, which does not form readily ignitable mixtures with air, a second material such as a light hydrocarbon, methyl ether, or methyl amine, is supplied with the ammonia to facilitate ignition. The second fuel may be dissolved in the ammonia or supplied from a second tank through suitable proportioning means.

TC 1055 — "Improvements in Methods and Apparatus for Improving Industrial Gases"—Georges H. DuPont, France.

In order to increase heating value per unit volume and hence increase suitability for use in internal combustion engines, a gas such as water gas or coke oven gas is either (a) enriched with acetylene and passed over a nickel catalyst to cause the contained hydrogen to convert the acetylene to ethane; or (b) passed over a catalyst to cause reaction of the contained CO and H_2 to make methane. Reaction (a) at 150°C. over nickel is stated to convert acetylene only to ethane but at 200°C. is stated to give some butane and at 250°C. "a relatively high proportion of liquid products". Recycling of products is recommended to facilitate temperature control.

TC 1100—"Recovery of Olefines from Gas Mixtures" — German Application I.63,375.

In processes where olefines are removed from gases by treatment with a solution of metallic salt, as mercury or copper salts, which form a precipitate with olefines, it is proposed to repeatedly contact gas with the solution, in finely divided form, without intervening separation of the precipitate from the solution.

TC 1102—"Cracking Catalyst"—German Application I.62,629.

Catalyst produced by forming a gel by adding to an aqueous sodium silicate solution an aqueous solution of one or more salts of metals of the 2nd to 8th groups, as the earth metals, titanium, tin, zinc, magnesium, metals of 5th or 6th group or of iron groups, filtering off and washing the gel, then heating slowly to 200° - 300°C. or higher, as to 800°C.

Proportions: gel 30 to 75% preferred. If SiO_2 and Al_2O_3 are both present, their proportions are preferably SiO_2:Al_2O_3 less than about 75:25.

Advantageous combinations: Silicon and "aluminum or magnesium or both" also one or more of zinc, tin, titanium, chromium, molybdenum, tungsten, iron, nickel or cobalt.

Catalyst may also contain carbon, such as graphite. Also may have added boric acid, as 0.2—10%.

TC 1104—"Catalytic or Thermal Conversion of Gases to Liquid Fuel"—German Application I.62,731.

With gaseous mixtures containing C_1, C_2, C_3, C_4, and C_4+, separate C_3 and lighter and crack or dehydrogenate this fraction, thermally or catalytically. Then separate and discard from the treated product the hydrogen and methane, recombine residue with C_4 cut and proceed with polymerization.

TC 1105—"Process for Carrying out Reactions Involving Hydrocarbons"—German Application I.63,206.

Process for carrying out reactions involving hydrocarbons (e.g., cracking, dehydrogenation, pressure hydrogenation) characterized by the use of a particular catalyst. The catalyst is produced by decomposition of natural aluminum silicates (such as kaolin, feldspar or alusite). The decomposition can be effected by fusing with alkalis or alkali carbonates and dissolving the fused mass in acid, or by heating of the silicates for 2 to 4 hours with diluted alkali lye, separating the liquid, washing out the residue and dissolving it in acid. The acid (HCl or H_2SO_4) must not be stronger than 5 to 8%. The resulting brine is allowed to congeal to a jelly, water washed until acid free and dried. During drying temperature is preferably increased to 400°C. and held for some time. Waterglass or aluminum salt solutions may be added to the brines or jellies to regulate the ultimate proportion of SiO_2 to Al_2O_3.

TC 1106—"Process for Carrying Out Reactions Involving Hydrocarbons"—German Application I.63,255.

Process for carrying out reactions involving cracking, dehydrogenation or pressure hydrogenation, characterized by use of a specific catalyst or catalyst carrier. Catalyst contains silicic acid produced by way of silicon halide and one or several metal combinations. Thus silicon tetrachloride is mixed with water and resulting silicic acid is mixed with solution of metallic salts, particularly aluminum or magnesium salt solution. Precipitant, such as ammonia also may be added if necessary. Precipitate is filtered off, washed dried and heated to 400° - 800°C.

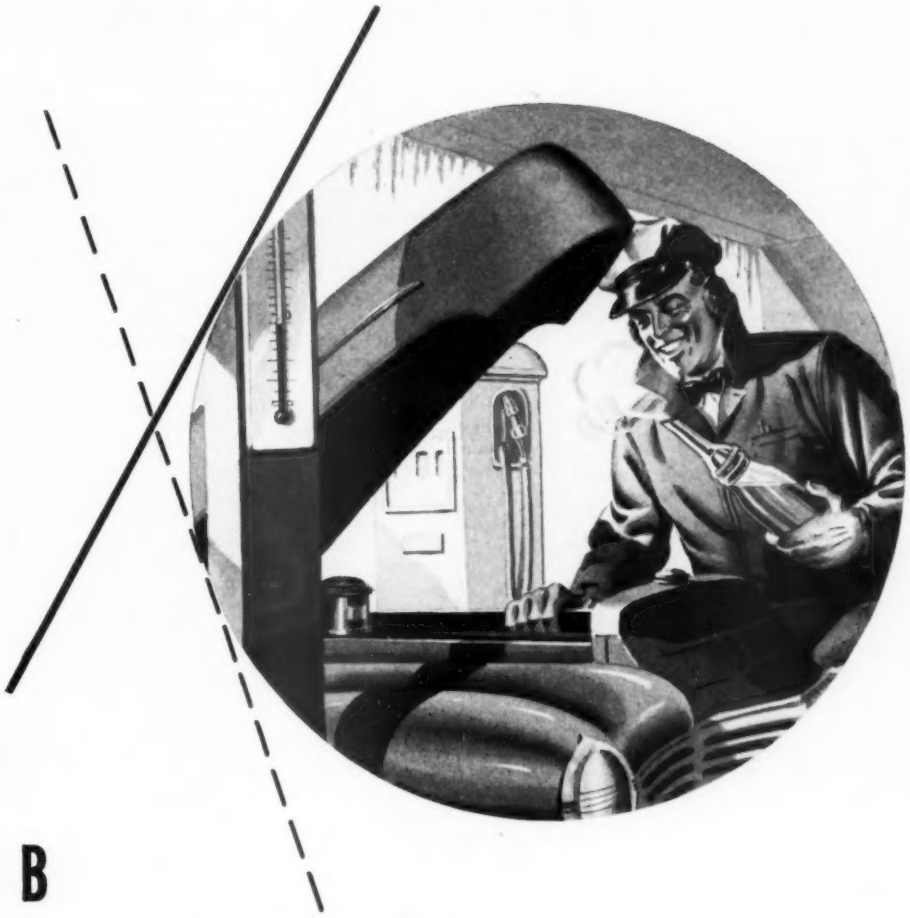
The catalyst is useful as carrier for other catalytically acting substances which may be added during or after production. Such other substances include the oxides or sulphides of titanium, iron, nickel, cobalt, tungsten, chromium, molybdenum, vanadium, or manganese, added in quantities from 0.1 to 15%.

TC 1107—"Catalytic Hydrogenation" — German Application I.62,836.

Process for the catalytic hydrogenation of coals, tars, oils and the like, characterized by use of a catalyst produced by mixing silicic acid brine or aqueous silicic acid gel with easily/or difficultly soluble combinations of magnesium, with joint use of a precipitant if necessary, drying or partially drying the mass obtained and adding combinations of the metals of the 5th or 6th group of the periodic system, and then heating to high temperature. The quantity of magnesium in the catalyst may vary from 3 to 50% and is preferably from 10 to 40%. In the example, the dried and pulverized gel is saturated with ammonium sulfotungstate dissolved in ammonium sulphide solution. This is decomposed in hydrogen at 400°C. and the finished catalyst contains 10% tungsten sulphide.

TC 1108—German Application I.67,401.

Catalysts on a silica gel base, prepared in any conventional manner, but preferably free from alkali metal compounds, are dried at 100 - 120°C. and then heated rapidly to at least 500°C., preferably in less than 20 minutes. Further heating to about 800°C. may be less rapid. Optionally a silica gel such as prepared by decomposition of silicon tetrachloride may be sprayed into a highly heated oven to get rapid drying and heating. A rapidly dried silica-alumina cracking catalyst is stated to give 41% gasoline from a paraffin base oil whereas a similar catalyst dried slowly



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would give only 36% gasoline under the same conditions.

TC 1110—German Application I.64,112.

Carbonaceous material such as lignite or bituminous schist which is to be subjected to pressure extraction is first wet with acidic material such as a mineral acid to neutralize all basic constituents. For example brown coal is neutralized with dilute sulfuric acid, wet with ammonium molybdate solution and digested with tetrahydronaphthalene at 365°C. under 100 atm. pressure for 2 hours which is stated to result in degradation of 92% of the coal.

TC 1112—German Application I.67,713.

Absorbents, catalysts, or catalyst carriers comprising insoluble basic metal sulfates, particularly basic aluminum sulfates, or comprising insoluble oxidic compounds obtained from basic metal sulfates by heating or by chemical reactions. Porous compositions are obtained when the atomic sulfur-aluminum ratio is 1:4. The basic sulfates can be formed into moldings or be used as a powder. In plasticizing these basic sulfates prior to molding they are agglutinated with soluble basic salts, preferably soluble basic sulfates or reversible colloidal hydroxides or salts, for example, highly-basic nitrates, chlorides, formates or sulfates of aluminum.

The initial basic salts of Al, Cr, Fe, Ni, Co, Mn, Sn, Cu, Be, Mg, Zn, Cd, Ti, Zr, Th, Ce are prepared from solutions of normal salts or salts having a lower basicity than that of the desired salt, preferably from solutions or normal or low-basic chlorides and nitrates of Al and Cr, by distilling off a corresponding part of the nitric or hydrochloric acid formed by hydrolysis, or by neutralizing part of the acid radicle by means of NH_4OH or with a base forming an insoluble salt, for example by treating the solution of an Al or Cr sulfate with a deficiency of $Ca(OH)_2$ or $Ba(OH)_2$ or carbonate, and by separating the insoluble part from the solution. Another method of preparing new basic metal halides consists in reacting solutions of normal or relatively low-basic halides of numerous metals (eg., Al or Zr) with alkylene oxides, and removing the organic byproducts by distillation or extraction. Suitable basic salts or reversible sols and gels of the corresponding metal hydroxides are those prepared by dissolving or peptizing metallic aluminum or hydroxides of the aforesaid metals (preferably aluminum hydroxide) with a deficiency of acids (HCl, HNO_3, formic acid, acetic acid, chloracetic acid) or with acid-reacting salt solutions (for example Al, Cl_3 solutions). Suitable basic aluminum salts are obtained by peptizing basic aluminum sulfites with hydrochloric acid followed by the removal of the SO_2 by heating with exclusion of oxygen.

Porous masses are obtained by heating the corresponding basic sulfites (aluminum sulfite for instance) in the presence of oxidizing agents (air). The basic, insoluble, porous metal sulfates can be used as adsorbents in numerous adsorbing and refining processes for example for drying gases or liquids, for the recovery of SO_2 from waste gases, for refining oils, for extracting nicotine from tobacco smoke, as a substrate for dye lakes, and as pigments. Also useful as catalysts and catalyst carriers, particularly in those catalysts involving hydrocarbons as starting or as the final materials, such as cracking, polymerization processes, aromatization (reforming), isomerization processes, alkylation, dehydrogenation, dehydration of monohydric or polyhydric alcohols.

TC 1113—**"Solid Fuel Gasification"**—German Application I.64,608.

Highly pulverulent solid fuel material may be gasified by wetting, mixing with fuel material of larger size and introducing to a gas producer of usual type, the gases from which are sent through a cyclone or similar separator, and the dry fines from such separator are reintroduced to the gas producer in the incoming stream of blast gases.

TC 1114—**"Pressure Hydrogenation Process"**—German Application I.63,251.

The usual pressure hydrogenation of paste of oil and solid carbonaceous material characterized by the use, as a "pasteing oil", of a hydrogen poor heavy product of a similar hydrogenation treatment.

TC 1115—**"Catalytic Cracking"**—German Application I.65,390.

In liquid phase with a suspended, finely divided catalyst, as silica, active carbon, etc., oxides, silicates and salts of metals, etc., in which temperatures are 460°C. and over, usually 480 - 520°C. and feed rates of over 5 and preferably 20-40 kg per litre reaction space per hour.

TC 1116—**"Solvent Treatment of Heavy Oils"**—German Application I.67,553.

Residual oils from petroleum, coal liquefaction, etc., are refined etc., by vacuum distillation, followed by solvent treatment with phenol, etc., (liquid extraction for cyclic materials) followed by treatment of the phenol-oil phase with a solvent such as propane.

TC 1117 — **"Producing Hydrocarbon Oils**—German Application I.65,192.

Residual oils, tars, or pressure hydrogenation products are treated at 420 - 470°C. in presence of hydrogen sufficient to exert 50% partial pressure to viscosity break a substantial portion without substantial gasoline production, and vaporous reaction products are withdrawn for further treatment as by cracking, pressure hydrogenation, vacuum distillation, etc.

TC 1119—German Application I.64,566.

Fine pored silica gel as prepared from acid or neutral solutions is impregnated with salts from water solution without disintegration (explosion) by first being heated to a temperature above the boiling point of the solution and then being saturated with water vapor before contacting with the solution. Examples are given for impregnation from solutions of cobalt chloride or copper nitrate but use for the resulting catalysts is not specified.

TC 1121—German Application I.66,989. (Addition to prior applications I.60,664 and I.62,630.

A cracking catalyst is prepared by adding a metal salt solution (particularly a magnesium salt) to waterglass in the presence of an excess of acid whereby very slow gel formation occurs, and not dissolving out a part of the metal as described in parent applications.

TC 1122—**German Application** (number not given).

Preheating hydrocarbon gas mixed with steam by effluent gas from a "tap generator", admixing oxygen with the preheated gas and passing the mixture through the generator to which fresh coke is charged and slag is recycled, for the purpose of converting the hydrocarbons to CO and H_2 for synthesis.

TC 1124—**"Production of Unsaturated Hydrocarbons from Solid Fuels"**—German Application I.64,662.

Unsaturated materials may be obtained from the dry distillation or partial combustion of solid fuel materials by first subjecting the effluent gases therefrom to condensation and removal of liquefiable material, a portion of the remaining gases are withdrawn from the process, the remainder are heated to 700 - 1000°C. and repassed through the distillation zone. Unsaturates may be recovered from either the effluent gases or from recycle prior to heating.

TC 1125—**"Production of Motor Fuels"** German Application I.64,601.

Motor fuel is produced by cracking the initial charging stock, hydrogenation of the recycle and higher boiling residues, and recracking of the hydrogenate product.

TC 1126—**"Catalytic Gas Reactions"**—German Application I.64,718.

In the conduct of gas reactions, as catalytic treatment of mixtures of steam and carbon monoxide, carried out in a first, high temperature stage, and a second stage at lower temperature, the improvement which comprises conducting the second stage in a plurality of streams through a plurality of beds.

TC 1127—**"Methods for the Production of Argillaceous Catalysts"** — German Application I.64,799.

Molded catalyst bodies having a high mechanical strength, a long-lasting catalytic efficacy and a great resistance to abrasion are obtained by first preparing aqueous pastes from commercial hydrated alumina and an alumina which is colloidally soluble in water, or basic aluminum nitrates, if necessary with addition of acids and/or kaolin or other clays. These pastes which on exposure to air spontaneously harden to masses of high mechanical strength, are molded and further hardened by heating to temperatures of 200 - 400°C. In order to increase the self-hardening capacity of the pastes there is added to the hydrated alumina some acid, preferably nitric acid, in an amount equivalent to about 10% of that required for the conversion of the total hydrate into the corresponding aluminum salt. To a hydrated alumina which has been rendered nonpeptizable by a preliminary heat treatment (up to 150°C. for example) kaolin or other clay is added to the base composition plus an amount of nitric acid as stated above. In this clay it is the kaolin or clay which is peptized.

In order to increase the catalytic activity of these base catalysts they are impregnated with trivalent to hexavalent Cr compounds or, metal chlorides or nitrates, such as $SnCl_2$, $MgCl_2$, $Cu(NC_3)_2$. A subsequent ignition converts these compounds into the corresponding oxides. The new catalysts are far superior

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to so-called "precipitation catalysts", and are to be used in the dehydrogenation of hydrocarbons, dehalogenation of halogenated hydrocarbons, addition of hydrogen to unsaturated compounds, catalytic oxidations, reductions, catalytic cracking, the aromatization of aliphatic hydrocarbons. They are particularly useful in catalytic processes in which carbon becomes deposited upon the catalyst which must frequently be reactivated by calcination (roasting).

In the first example a powdered commercial hydrated alumina is mixed in a ball mill with about 10% kaolin and about 5% of the amount of nitric acid needed for the formation of aluminum nitrate. The paste is molded into the proper shape, the molded bodies which harden spontaneously in the air, are heated to about 350°C. Upon cooling the molded bodies are impregnated with a chromium nitrate solution and heated to 400°C., to convert the nitrate into the oxide. The finished molded body is to contain about 8% Cr_2O_3. When 200 parts by volume of isobutane are passed per hour over 1 volume of this catalyst at 550 - 600°C. an 83% yield of isobutylene is obtained with a conversion factor of 20%. After each 100 hour run the catalyst is reactivated by passing over it a nitrogen-air or nitrogen-air-steam mixture. Runs totalling 2000 hours can be made with a single catalyst charge without appreciable loss of activity or strength of the catalyst.

In the second example n-butane is dehydrogenated to n-butylene by means of catalyst prepared similarly from 80 parts of a hydrated alumina "(Baeyer process alumina)" and 20 parts of a water-soluble alumina prepared in accordance with German application I.58,014 IV b/12 m. The self-hardened bodies prepared from this mix are impregnated with an aqueous chromic acid solution so that the final catalyst contains 80% of Al_2O_3 and 20% of CR_2O_3. Calcination of the molded catalyst bodies is effected at about 600°C.

According to the third example a paraffinic middle oil containing no aromatic hydrocarbons is passed together with hydrogen under a pressure of 12 atmospheres over an alumina-chromium oxide catalyst at a rate corresponding to 1.2 liters of oil per liter of catalyst per hour, the hydrogen used amounting to 500 liters per 1 kg of oil. The final product contained about 35% of aromatic hydrocarbons. The catalyst contained 5% of Cr_2O_3.

TC 1130—"Treatment of Hydrogenation Residues"—German Application I.63,-719.

Hydrogenation of ashy coals etc., yield a residual mixture of oils and solids. This may be treated by oxidizing, dehydrogenation, or sulphurization and then subjected to separation by filtering or centrifuging.

TC 1131—"Treatment of Hydrogenation Residues"—German Application H.161,-623.

Hydrogenation of ashy coals etc., yields a residual mixture of solids and heavy oils. This may be treated by heating to vaporize heavy oils with low temperature carbonization of the remaining portion.

TC 1132—German Application I.64,792.

In the preparation of silica base catalysts a water soluble gas such as ammonia is passed through the silica gel until all air is removed, after which the desired additional metal compound such as alumina, is added by impregnation from a water solution of a suitable salt. A silica-alumina cracking catalyst prepared in this manner is stated to give a gasoline yield of 30% gasoline compared with 15-20% yield from a similar catalyst made without ammonia stripping.

TC 1133—German Application (Number not stated).

Catalysts or catalyst carriers for various hydrocarbon conversions are made by wetting clay with a solution of a salt of metals of the 2nd to 8th groups, and particularly of the 2nd and 7th groups, and washing until no more salt is removed. Examples are given of the production of cracking catalyst by thus treating Deggendorfer clay with 20% $AlCl_3$ solution or concentrated manganese sulfate solution or 20% magnesium sulfate solution. In the latter case cracking of Iranian gas oil is stated to give yields of 45% gasoline and 1.9% gas whereas the untreated clay would have yielded 26.5% gasoline.

TC 1134—German Application I.63,779.

Essentially horizontal reaction tubes are used for the synthesis of hydrocarbons from CO and H_2 which is stated to give more effective heat transfer to the surrounding coolant thus permitting operation at higher pressure without excessive methane formation.

TC 1135—"Treatment of Low Temperature Tars"—German Application I.66,-012.

Tars from low-temperature carbonization, having high gravity and high pour (solid) point, may be reduced in large part to useful lighter fuel oils of low pour point by cutting into a light useful fraction and a heavy fraction, treating the heavy fraction by hydrogenation to obtain a useful lighter oil, and blending this with the light fraction of the original tar.

TC 1136—German Application I.63,572.

For the synthesis of predominantly solid paraffins from CO and H_2 the catalyst is made by precipitating a compound of a metal of the iron group on aluminum oxide and immediately reducing the precipitate.

TC 1137 — "Recovery of Heavy Oils from Hydrogenation Etc. Processes"—German Application I.64,071.

Vaporization of heavy fractions assisted by the addition to reaction stream, between reactor and vaporizer, of additional lower boiling material as vaporization assistant.

TC 1139—German Application I.63,689.

A catalyst for hydrocarbon processing, and particularly for cracking, is made by prolonged digestion of silicic acid, alumina, or clay with a solution of a metallic salt, particularly of aluminum or magnesium, followed by washing, drying, and heating to 500 to 800°C. For example silica gel is soaked in a solution of aluminum nitrate for 3 hours at 80 to 100°C., then washed and dried at 100 to 150°C., then heated to 600°C. and held at this temperature for 3 to 6 hours. The product is stated to be an active cracking catalyst. Other catalytic materials may be added to supports prepared in the manner described.

TC 1140 — German Application I.63,-093.

In the (destructive) hydrogenation of carbonaceous materials at pressures above 300 atmospheres and particularly at about 700 atmospheres, plugging of the conduit leading to the wash tower is avoided by injecting wash oil into the gases leaving the reactor or leaving the stripper if such is used.

TC 1141—German Application I.63,873.

The product of mild (destructive) hydrogenation of carbonaceous materials is fractionated to separate gasoline boiling up to 200°C. and Diesel oil boiling from 200 to 280°C. The material boiling above 280°C. is subjected to catalytic cracking, preferably with recycle of gaseous hydrocarbons, and corresponding fractions of the cracked products are blended with the primary gasoline and Diesel oil. Anti-knock value of the gasoline and pour point of the Diesel oil are thereby improved.

TC 1142—German Application I.63,658.

For the synthesis of hydrocarbons from CO and H_2 reaction tubes are arranged in rows with the tubes close together in each row but with the rows suitably spaced for circulation of coolant.

TC 1144—German Application I.65,092.

In the (destructive) hydrogenation of carbonaceous materials hydrogen is recycled without purification after being heated above its dew point to avoid difficulties due to corrosion, varnish formation, and dilution of compressor lubricant. Heating may be accomplished by returning part of compressed gas through a heater to the compressor intake.

TC 1148—German Application I.62,847.

Catalysts for polymerization or condensation reactions are made by treating activated clays such as Tonsil with heteropoly acids such as phosphotungstic acid, and optionally adding heavy metal salts as of silver, nickel, or copper. Examples are given of the use of such catalysts for alkylating aromatics with olefins. Attached letter states that such catalysts "show only a slight improvement compared with similar catalysts so far known".

TC 1149—"Low Temperature Carbonization"—German Application I.61,317.

Improvement in a process of low temperature coking by partial combustion, comprising pretreating the solid, which is usually in powder-form with a heavy residual oil from hydrogenation, at temperatures of 50 - 150°C. to form a lumpy feed material.

TC 1150—"Catalyst or Catalyst Carrier"—German Application I.63,256.

Catalyst or catalyst carrier is produced by mixing a sodium silicate solution and a sodium aluminate solution, and washing the precipitate, which is then taken up in a weak mineral acid. A gel is formed, washed free of acid, and dried.

TC 1151 — "Hydrogenation Process" — German Application I.63,092.

Residual oil boiling above 325°C. mixed with 0.5% of gas generator dust (carbon 7), is heated to 450°C. under a

pressure of 250 atm of hydrogen and passed into a reaction chamber, from the bottom of which 2% (based on feed) is continuously withdrawn. Catalyst is added to this reactor above the point of feed. Catalyst is lignite carbon, acid treated, carrying molybdenum oxide and is introduced in admixture with oil to the extent of 0.5% based on feed. Reactor is held at 472°C. Reaction products go to a separator held at 460°C. from the bottom of which 5% (based on feed) is continuously withdrawn. Hydrogen and vaporous hydrocarbons are drawn from the top of the separator, 55% of the hydrocarbons boiling below 325°C. Reactor and separator drags are carbonized at low temperature. Heavy oils are recycled.

TC 1152—"Coal Liquefaction"—German Application I.63,116.

Crushed "coal" mixed with oil, which oil is preferably non-asphaltic, is passed together with hydrogen at high pressure through a reactor containing catalyst, as supported metal sulphides or metal oxides, the temperature level along the reactor rising in the direction of flow of reactant. The first quarter of the reaction is conducted at 270-350°C.

TC 1153—German Application I.62,832.

Carbon monoxide-hydrogen mixtures for synthesis are obtained by reacting hydrocarbons such as methane with steam and CO_2, and making the steam and CO_2 at least in part by the reaction of hydrocarbons with a reducible metallic oxide such as copper oxide or oxides of metals of the iron group.

TC 1154—"Coal Liquefaction"—German Application (Number not given).

Coals, peats, bituminous shales, etc. are mixed with oils and extracted at high temperature (200-500°C.), and high pressure, (50-500 atm.), and the operation is improved by the presence of heavy metal sulphides, heavy metal oxides, etc., with or without gaseous or liquid sulphur compounds.

TC 1155—German Application I.62,983.

To permit combustion, gasification, or other use of highly alkaline brown coals without difficulties from slag formation, there is added to the coal either SiO_2 alone or silica plus alumina, or materials containing these oxides (for example coal of low alkali content) in such amounts that the weight ratio of $SiO_2 + Al_2O_3$ to Na_2O is greater than 1, and at least as much SiO_2 as Al_2O_3 is present, and preferably 1 to 3 parts by weight of SiO_2 to one part of Al_2O_3.

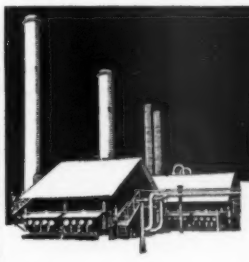
TC 1156—German Application I.63,192.

Diesel fuel is made by blending oil deficient in hydrogen, such as obtained by mild hydrogenation of coal, with hydrocarbons boiling above about 200°C. obtained by the cracking of the product of the hydrogenation of carbon monoxide. This cracked oil, preferably from catalytic cracking, is stated to be relatively rich in hydrogen and yet will not permit separation of asphaltic matter from the blended fuel.

TC 1157—"Working Up Solid Organic Materials"—German Application I.61,317.

Crushed coals, etc., are mixed with residual products of hydrogenation of coals, tars or mineral oils, in proportions of 0.05 to 0.3 parts residual hydrogenation product to 0.95 to 0.7 parts solid and mixture is subjected to low temperature carbonization.

Metal, mother of progress, could never have been made useful without fire. Countless centuries passed before some early genius discovered metal could be obtained from certain rocks and stones with the application of fire. Down through the centuries smelting has supplied the basic raw material for craftsmen as well as industry. In petroleum as in most refining processes, fire makes the difference between success or failure. In world famous refineries Alcorn heaters are setting new records for increased production and lower operation costs. Alcorn's 20 years of engineering experience and research merits your consideration for the successful heating of hydrocarbons.



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TC 1158—German Application I.64,446 (Addition to I.53,929).

In the synthesis of hydrocarbons from CO and H_2 the heat of reaction is removed by passing liquid through the catalyst bed and simultaneously cooling the walls of the reaction tubes by a surrounding liquid such as water.

TC 1159—"Reducing Liquid Hydrocarbons from Tars" — German Application I.63,032.

Residual oils, such as tars from low temperature carbonization of lignites, are heated rapidly to about 350°C. without substantial cracking and flashed to give clean overhead for use in cracking or pressure hydrogenation.

TC 1161—"Production of Motor Oils"—German Application I.63,219.

Non-synthetic lubricating oils of low viscosity may be blended with synthetic lubricants of 6° - 7° Engler viscosity at 99°C., the latter having been produced by polymerization of olefines of 3-8 carbon atoms.

TC 1165—"Production of Motor Fuel"—German Application (Number not given).

Motor fuels of high anti-knock ability may be produced from naphthenic materials of gas oil boiling range by cracking in the presence of catalyst and hydrogen under conditions such that substantially no hydrogen is consumed. Charge oil vapors, at 440 - 550°C. under a total pressure of 25-90 atmospheres, with hydrogen present sufficient to provide a partial pressure of 30-50% of the total, preferably about 20 atms. are passed over oxides of the metals of the 2nd to 5th group, as chromium oxide on alumina, with recycling of the hydrogen containing gases of the process to the extent of 0.3 - 1.5 cubic meters gas per kilogram of charge oil. The gasoline fraction produced is highly aromatic and of good knock rating. (Example: 82 octane [method not specified]).

TC 1166—German Application I.65,515.

Highly unsaturated gum-forming constituents are removed from cracked gasoline and the like by hydrogenation with a zinc sulfide catalyst at a temperature below 300°C. and preferably between 180 and 250°C. Hydrogen pressure of more than 20 atm. and preferably 100 - 200 atm. is used. Aromatics and monoolefins are stated not to be hydrogenated under these conditions and anti-knock value is not reduced nor is sulfur content materially affected.

TC 1167—German Application I.65,516.

Same process, object and result as described in TC 1166 but with copper sulfide as the catalyst.

TC 1168—German Application I.65,517.

Same process, object and result as described in TC 1166 but with tin sulfide as the catalyst.

TC 1169—"Pressure Hydrogenation" — German Application I.65,989.

Destructive hydrogenation or cracking may be accomplished by passing oil as vapor through a moving bed of catalytic material at 360 - 480°C. with a catalyst/oil ratio of at least 4 volume/1 volume (liquid?).

TC 1170—"Catalytic Polymerization"—German Application I.64,049.

When polymerizing gaseous olefines, as to form gasoline, over catalysts such as phosphoric acid or its salts upon a supporting contact mass, arrange the contact mass bed so that those portions nearest the entry point of reactant gases are lowest in concentration of catalytic material.

TC 1171 — "Process for Cracking Carbonaceous Substances"—German Application I.66,959.

In the cracking of carbonaceous substances particularly hydrocarbon oils, in the presence of catalysts containing alumina and boron compounds (particularly boric acid or borates, such as ammonium borate) good yields of low-boiling constituents without appreciable losses due to the formation of gaseous hydrocarbons or high-molecular condensation products, are obtained by using an alumina prepared entirely or mostly from a non-aged aluminum hydroxide. These catalysts are distinguished by a great hardness, high initial efficiency, a relatively slow drop in activity, and a good regenerability.

Non-aged aluminum hydroxide is a hydrated form of alumina capable of directly forming with water a colloidal solution or after a treatment with a peptizing agent, such as HCl or HNO_3, the amount of the latter being substantially less than that required to convert the total Al into the normal salt (chloride or nitrate). It can be prepared from solid or dissolved, preferably highly basic aluminum salts, or from a colloidal aluminum hydroxide containing such salts, care being taken that in the preparation of the hydroxide in the presence of non-volatile alkalies a strong alkaline reaction is avoided.

Suitable starting materials for the preparation of non-aged aluminum hydroxide are for example basic aluminum salts such as are obtained by dissolving powdered aluminum in a deficiency of acid or aluminum salt solution, or by the electrolysis of an aluminum salt solution, or by reacting an aluminum salt solution with alkylene oxides followed by the removal of the organic substances, for example by distillation, or by peptizing hydroxides with a deficiency of an acid or acid-reacting salt. Other highly basic salts are those obtained as a liquid or solid residue from solutions of the normal salts or salts having a lower basicity than the one the desired salt is to exhibit, preferably from solutions of normal or low-basic chlorides and nitrates of aluminum, by distilling off an adequate part of the HCl or HNO_3 formed by hydrolysis. Excellent non-aged starting materials are furthermore obtained by heating basic aluminum sulfides, if necessary in the presence of peptizing agents, such as HCl, for the purpose of removing SO_2, in which event oxygen is to be kept away as much as possible. These starting materials can be further worked up by precipitation or by thermal means. In the latter event basic Al salts having a low content of residual volatile acids are particularly advantageous as in this case the strength of the catalyst suffers least on heating and expelling the residual acid and its microstructure is thus best preserved.

Commercial hydrated aluminas, prepared from a strongly alkaline solution in the presence of non-volatile alkalies, is a strongly aged and thus little efficacious, badly peptizable aluminum hydroxide.

Besides boron compounds the catalysts may also contain other catalytically acting substances. Thus, the joint utilization of activated alumina with boron compounds and substances having dehydrogenating isomerizing, and aromatizing propensities, particularly the oxides of Cr and Mo, makes possible the production of a gasoline having a particularly high anti-knock value.

Preparation of the catalyst: The highly basic Al salt or the reversible colloidal aluminum hydroxide gel or a mixed gel from the hydroxides of Al and Cr, is molded into various shapes (cylinders, hollow cylinders, balls) gently dried, and then dehydrated by heating to 200 - 600°C., preferably 400°C. and thus converted into the water-insoluble form, whereupon the porous oxide thus obtained if necessary after a short etching with a highly diluted acid and repeated washing and drying is impregnated with boric acid and, if necessary, with supplementary additives, as for example with ammonium or K bichromate or with Cr and alkali compounds, and finished in the conventional manner.

Catalyst mixtures comprising non-aged readily peptizable or already peptized aluminum hydroxide and boron compounds are preferably extruded through molding dies and heated to 200 - 600°C., preferably 400°C. Best ratio: 100 parts of Al_2O_3 to 10-30 parts of B_2O_3.

Particularly suitable starting materials are highly reactive readily peptizable aluminum hydroxides or already peptized aluminum hydroxides which are then in a water-soluble reversible colloidal form, such as those obtainable in accordance with German applications I.47,587 IV b/12 G; and I.49,390 IV b/12 g; I.49,-389 IV b/12 M; and I.59,180 IV b/12 M. The process can be carried out both by means of fixed catalysts or by catalysts continuously impelled through the reaction space.

TC 1173—German Application I.64,615 (Addition to German Application I.60,-664).

In the preparation of a silica base cracking catalyst waterglass is acidified, as with HCl to a pH of about 3.5 before addition of aluminum nitrate solution for precipitation of mixed gel. This is subsequently washed and dried. More active catalyst is stated to result from this method but comparative data are not given.

TC 1175—German Application I.64,209.

Translation of claims: 1. Process for treating fluorine-containing silicic acid for the obtainment of porous masses capable of serving as adsorbents or catalysts, preferably catalysts for reaction with carbonaceous substances, said masses containing metal or metal compounds, by washing and drying, as well as a treatment with alkalies up to the point where a mass is formed which contains waterglass and is to be acted upon by a decomposing agent, characterized in that the fluorine-containing silicic acid whether while it is being formed or subsequently thereto, or the

waterglass containing mass obtained therefrom or the silica isolated therefrom by means of decomposing agents, is subjected to a treatment such that the fluorine compounds are either practically eliminated or are converted into other compounds inocuous as regards the adsorbing power or the catalytic activity.

2. Mode of carrying out the process according to claim 1, characterized in that a preferably faintly acid silicic acid sol is produced by mixing a fluorine-containing waterglass with decomposing agents in the presence of stabilizers which lower the solidification velocity of the sol, which is increased due to the presence of fluorine compounds.

3. Process according to claim w, characterized in that the stabilizers used consist of salts of metals adapted to function in a trivalent or tetravelent form, particularly aluminum salts, and in that these are admixed with the decomposing agent used to react with the waterglass.

4. Process in accordance with claims 1-3, characterized in that a waterglass solution containing fluorine is decomposed with fluorine-containing decomposing agents of such a kind as to form sparingly soluble silicofluorides, particularly alkali metal silicofluorides, which are separated by mechanical means from the silicic acid sol which is caused to set to a gel which is then dried, washed, and activated by heating it to a relatively high temperature.

The desired silicic acid sol should have a pH of 1.5 - 5, preferably 3.

TC 1176 — "Catalytic Cracking" — German Application I.64,580.

Vapor phase cracking over catalyst in a reaction zone heated only by incoming reactant, wherein vapors are fed at high velocity through the major reaction zone to keep it at higher temperature, with reaction completed by passing portions of the vapors through subsequent reaction zones.

TC 1177—"Gas Washing—Selective Absorption"—German Application I.63,397.

In selective absorption of gases, such as hydrocarbon mixtures, a process applying high pressure absorption followed by stripping at lower pressure in multiple stages, with return of stripper gases from lower pressure zones of the multiple stage stripper to higher pressure zones thereof. Utilized for separation of C_2, C_1 and H constituents of hydrocarbon gases.

TC 1178—German Application I.63,535.

Process for catalytically splitting off hydrogen or its compounds with the aid of porous oxides, hydroxides or salts acting as catalysts consisting entirely or mostly of non-aged hydroxides. These hydroxides after heating them at least to the working temperature of the catalyst, preferably to 450 - 460°C., have a pH between 2 and 7, preferably 5-6. The non-aged hydroxides are prepared from basic, preferably highly basic salts or from colloidal hydroxides containing them. The hydroxides particularly aluminum hydroxide, are precipitated from reacting solutions, the precipitate is separated from the bulk of the salt impurities by washing, and is then heated to a temperature such that the granules are not destroyed by contact with a washing liquid, whereupon the granules are washed with acid or alkaline substances depending upon the kind of impurities of the catalyst, so that the catalyst after heating to 450-460°C. has a pH between 2 and 7, preferably between 5 and 6.

In order to get the proper pH the aforesaid precipitates must be washed either during a very long time and the pH of heated samples rechecked from time to time, or a better washability must be brought about by heating. Alternatively, the precipitates can also be washed less thoroughly then heated to a suitable temperature; in case the dry products are still too acid, the latter are heated with aqueous solutions of ammonia, ammonium carbonate, urea, ethylene oxide or in case they are too alkaline they are treated with preferably volatile acid agents (aqueous solutions of HC_1, HNO_3, HCO_3).

Non-aged hydroxides are defined as being water-containing modifications of the oxides which are capable of forming with water a colloidal solution either directly or after a treatment with a peptizing agent such as hydrochloric or nitric acid, the amount of which is substantially below that needed for the conversion of the aforesaid oxides into the chloride or nitrate, respectively. In the preparation of the hydroxide in the presence of non-volatile alkalies a strong alkaline reaction must be strictly avoided.

The non-aged hydroxide after being molded is dehydrated to a far-reaching extent by treating it at relatively high temperatures, and is thus converted into a water-insoluble form. Oxides having a sufficient porosity and derived from aged hydroxides can be used as carriers by coating them superficially with a gel or with basic salts, or a non-aged hydroxide can be deposited upon the carrier and the mass then adjusted with respect to pH.

Suitable to serve as catalysts are those oxides, hydroxides and salts as are conventionally used for splitting off hydrogen and its compounds from organic substances, specifically oxides, hydroxides and salts of those metals adapted to assume a trivalent or tetravalent form, for example, Th, Ce, Al, Fe, Cr, if necessary also Ti, Zr, Mn, Sn, V, No, W, U, Ni, Co, or mixtures thereof or mixtures with other substances (silica, boric acid, phosphoric acid, sulfuric acid).

Suggested uses for the new catalysts:

Isobutylene from isobutanol or isobutane.

Ethylene from ethyl alcohol.

Propylene from isopropanol.

Tetrahydrofurane from 1.4-butyleneglycol.

Phenylpyrrolidine from tetrahydrofurane.

Aniline and methyl pyrrolidine from tetrahydrofurane and methylamine.

Dimethylaniline from aniline and dimethyl ether.

Hydrocyanic acid from carbon monoxide and ammonia or formamide.

Alkylamines from alcohols and ammonia.

Diphenylamine from aniline by splitting off ammonia.

Silica-alumina contact masses particularly suitable for cracking hydrocarbons.

The favorable pH of the catalyst can be the more on the acid side the less the initial or end products tend to resinify and the higher the temperatures to which the catalyst are exposed during the process or during reactivation in case the catalyst contains non-volatile alkalies.

TC 1179—"Washing Gases. Foam Suppression"—German Application I.63,646.

Foam in gas washers, etc., may be suppressed by adding to the wash liquid combinations of polylicol ether residues with materials containing hydroxy, carboxy, amino, or mercapto groups, as combinations of

Ethylene Oxide and Octyl, etc., alcohol
Ethylene Oxide and Stearic, etc., acid
Ethylene Oxide and Oleylamine, etc

TC 1181—German Application I.63,134.

Silica base catalysts for cracking polymerization dehydrogenattion hydrogenation etc., are made by precipitation from waterglass under conditions to avoid the presence of any alkali metal in the finished catalyst. Silica-alumina catalysts are described particularly. The addition of 0.2 to 10% boric acid is also proposed. Other metal compounds including sulfides may also be used in addition to alumina or magnesia.

TC 1182—"Catalytic Cracking" — German Application I.62,627.

Catalytic cracking over a cracking catalyst which is not strongly polymerizing, as aluminum silicate, under pressure of 150-200 atmospheres and upwards, at temperatures 400-650°C., such that a major portion of the starting material is in vapor form.

TC 1184—German Application I.66,058.

A catalyst, particularly for cracking, is made by precipitating a barium salt with silica gel, to get 0.5 to 10% barium in the finished catalyst. Such a catalyst is stated to have the particular advantage of being easier to regenerate than other silica base catalysts. It may be used for cracking with or without added hydrogen, and is stated to be effective for cracking heavy naphthas. Such a catalyst may also be used as a carrier for oxides, sulfides, or other compounds of metals of the 5th to 8th groups.

TC 1185—"Liquefaction of Solid Organic Materials, as Coals"—German Application (number not given).

In the liquid extraction of coals, peats, bituminous shales, etc., by mixing finely divided solids with oils and treating at high temperatures, (200 - 500°C.) and high pressure, (20-500 atm.), operation is bettered by adding organic compounds of heavy metals, as oxalates, formates, acetates, naphthenates, or oleates of tin, zinc, molybdenum, chromium, tungsten, iron nickel, or cobalt.

TC 1186—"Reactions between Gases and Liquids"—German Application I.65,045.

Reactions between gases and liquids such as pressure hydrogenation, may be more effectively carried out in a reaction coil which has, at intervals along its length, internal constrictions to give short sections of high velocity flow.

TC 1187—"Liquefaction of Solid Organic Material, as Coals"—German Applications (number not given).

In the liquid extraction of coals, peats, bituminous shales, etc., by mixing finely divided solids with oils and treating at high temperatures, (200-500°C.), and high pressure, (20-500 atmospheres), operation is improved by adding small amounts of halides of solid metalloids, especially organic halides or ammonium chloride.

TC 1188—German Application I.67,099.

For the synthesis of hydrocarbons from CO and N_2 a cobalt catalyst is supported on alumina which has been heated sufficiently to convert it to the alpha form. Such a catalyst is stated to give relatively high yields of high boiling (above 320°C.) hydrocarbons.

TC 1189—German Application (number not given).

Process for the production of organic, particularly liquid products, from solid organic substances by solvent extraction under pressure, in which both the yield and quality of the extracted substances are increased by carrying out the pressure extraction in the presence of halides of Mo, W, or V. Other catalytically acting substances may be added, viz., heavy metals, particularly those of the 6th to 8th groups of the periodic system, or their sulfides or oxide, or organic metal compounds, such as the oxalates, formates, acetates, naphthenates, oleates of Sn, Zn, Mo, Cr, W, Fe, Ni, Co or Al. The catalysts can also be used in conjunction with a halogen or with halides of solid metalloids, such as organic chlorine, bromine, or iodine compounds, or halogen compounds of S, Se, Te, P or B. Particularly beneficial are organic halogen compounds, for example the Cl, Br, or I derivatives of methane, ethane, propane, butane, ethylene, butylene, or of benzene, naphthalene or anthracene. Acid-acting substances may also be added, viz., mineral acids such as H_2SO_4, HNO_3, or organic acids such as acetic acid.

Diluents such as activated alumina or bleaching earth, which in turn may be associated with catalysts, may advantageously be used.

Amounts of catalyst used: 0.1-10%, preferably 1-5%.

Raw materials subjected to this improved pressure-extraction process are coals, peat, bituminous shale.

Solvents suitable for this process: benzine, middle oils, heavy tar oils, products obtained in the pressure hydrogenation of coal or tars, also mineral oil fractions, liquid cyclic organic compounds (tetrahydronaphthalene). Mineral oil fractions boiling preferably above 300°C. are preferred as solvents. The amount of solvent used may be the same or a multiple (preferably the latter) of the material to be treated. The extraction is carried out at 200-500°C. preferably 300-420°C., and under a pressure of greater than 20 atmospheres, preferably 50-200 atmospheres. The extraction vessel can be heated by electrical resistance wires or by metal baths. The extraction can also be carried out with the assistance of scavenging gases (steam, nitrogen, or small amounts of hydrogen).

According to the example, finely ground anthracite is mixed with 3% of molybdenum chloride. The coal is made into a paste with 1½ times its weight of tetrahydronaphthalene, and heated under a pressure of 100 atm. to 415°C. in a gas-heated coil. Thus preheated the paste is passed into a wide reaction vessel in which it is held during 2½ hours. 92.5% of the coal is thus "broken down".

TC 1190—German Application I.63,257.

For the synthesis of hydrocarbons from CO and H_2 an iron catalyst containing an alkali borate is used. For example iron powder, from the thermal decomposition of iron carbonyl, is treated with 1% sodium borate (dissolved in water) then dried, pilled, and reduced with H_2 at 850° for 4 hours. Letter in file states that corresponding Italian application (Italian patent 379,250) is limited to use of sintered iron.

TC 1192—"Catalytic Processes" — German Application I.65,255.

In processes where liquid reactants are passed through fixed-bed contact masses, operations may be improved by adding materials which reduce the surface tension of the liquids, i.e., permit them to more readily "wet" the contact mass.

TC 1196—"Catalytic Production of Alcohols from H and Co, etc."—German Application I.64,683.

In producing higher alcohols by catalytic reactions of hydrogen and carbon monoxide, the retarding effect of nitrogen upon the desired reaction may be avoided by first treating the usual mixture of hydrogen, carbon monoxide and nitrogen to form methanol, then treating the methanol in the absence of nitrogen, in a second step for the production of higher alcohols.

TC 1200—German Application I.64,340.

A catalyst for the dehydrogenation of paraffin hydrocarbons comprises chromium oxide plus a small amount of alkali or alkaline earth halide as covered by German Application I.55,196 with the further addition of oxides of zinc or aluminum. In attached correspondence this is said to be covered by British patent 478,003.

TC 1201—German Application I.63,403.

Oxidation inhibitors for lubricating oils made by the reaction of alkylphenols with sulphur halides are improved in effectiveness by digestion (in solution) at 120-150°C. for 4-8 hours with metals of the 2nd to 4th group or their oxides or hydroxides, particularly aluminum or tin.

TC 1204—German Application I.62,993.

Salt-containing colloidal solutions (sols) of hydroxides of trivalent or tetravalent metals obtained by precipitating solutions of salts of these metals with compounds capable of forming their hydroxides. The hydroxide precipitates are separated from the bulk of the mother liquor, slightly washed, and while still containing absorbed salt are treated with a fraction of the initial amount of the acid-reacting metal salt or with a small amount of another acid-reacting substance, preferably with heating, in such a manner that the solution obtained contains at least 30 grams, preferably 100 grams and more, of the metal hydroxide per liter, and at most one half, preferably less than one third, of the amount of the acid radicle required for the formation of the normal metal salts.

The salt-containing sols are further worked up into water-soluble salt-free metal hydroxide sols (reversible gels) and into porous active masses such as adsorbing agents, catalysts, carriers, base and ammonia exchange compounds, etc.

Precipitation is effected at a pH at which the precipitates are still well filtrable but at which they are also well peptizable.

For highly dispersed solutions, precipitation is effected in an acid medium.

High degree of dispersion and satisfactory filtrability is obtained when, as in the precipitation of sodium aluminate by nitric acid, the pH at the beginning of the precipitation (20°C.) is adjusted at 5.5 and at the end (50-60°C.) at 4.5.

The metal salts referred to above are those of Al, Fe, Cr, Th, Ce, Ni, Co, Ti, Zr, Sn, Mn, but also the salts of Pb, V, Mo, W, U.

The metal salts to be decomposed are used in solid form or in the form of solutions or as fusions in the water of crystallization ($Co(NO_3)_2$ for instance). Precipitating agents are ammonia, ammonium carbonates or sulfides, alkali metal carbonates or bicarbonates, urea, pyridine, amines, alkylammonium hydroxides.

Alkali aluminate solutions are precipitated with acids (H_2SO_4, HNO_3, HCl) or with solutions of NH_4Cl, NH_4NO_3, or with Al $(NO_3)_3$ solutions.

For the preparation of mixed catalysts mixtures of various metal salts are converted into the metal hydroxide sols. Waterglass, silicon tetrachloride, or silicic acid sols are added to the metal salts (i.e., solutions of aluminates or other aluminum salts) or to the precipitants in order to stabilize the final products with colloidal silica.

The salt-containing metal hydroxide sols particularly those of Fe or Al are good protective colloids.

For many purposes it is important to adjust the pH in the precipitation and the amount of the acid component required to dissolve the salt-containing precipitate, in such a manner that the sol obtained spontaneously gels to a homogeneous jelly in any desired time.

The gels formed during the setting of the acid sol are converted into a *water-soluble dry* product by a moderate drying at 60-120°C. It can be freed from ammonium salts by organic solvents, e.g., alcohol.

Unwashed alumina gel converted into active alumina by gradual drying at a moderate temperature followed by heating to 400-500°C. A faintly acid pH (below 7) in the alumina gel gives during drying a product with small pores. A faintly alkaline pH (above 7) promotes the formation of large pore gels. The latter are above all useful as carriers for catalysts. For example, activated alumina impregnated with an ammoniacal copper solution and thermal treatment yields a catalyst for the hydrogenation of aldol to butylene glycol. Activated alumina loaded with chromium oxide or hydroxide is useful for the dehydrogenation of hydrocarbons, such as

butane and isobutane to butylenes and isobutylene, respectively.

Cobalt oxide catalysts containing thoria are particularly useful for the production of liquid hydrocarbons from CO and H_2.

The acid gel prior to being washed is treated with liquids which render it as insoluble as possible, for example aluminum hydroxide gel is treated with enough H_2SO_4, H_3PO_4, phosphate solution, etc., to form insoluble aluminum hydroxide or insoluble basic aluminum sulfates or insoluble phosphates. These on washing and drying yield porous, catalytically active masses.

The salt-containing metal hydroxide sols the impure and pure gels derived therefrom, as well as the salt-free reversible gels, their solutions are useful as agglutinants. Alumina-containing sols or gels can be associated with silica gel, waterglass, $SiCl_4$, SiF_4, silicic acid esters, hydrofluosilicic acid or its salts to form catalysts containing 5-30% Al_2O_3 and 95-70% SiO_2 for the thermal treatment of hydrocarbons (cracking, polymerization of unsaturated hydrocarbons, destructive hydrogenation, desulfurization, etc.).

TC 1209—German Application I.63,454 (Addition to German Application I.55,-776).

Finely divided coal is made into a paste by means of an oil having a boiling point greater than 200°C. (preferably greater than 325°C.) and preferably free from asphaltic matter. An oil derived from the name coal is most suitable. Paste contains up to 50% coal. Paste is subjected to pressure hydrogenation in a plurality of series-connected upright reactors through which it is passed from the bottom upwardly. Vaporous reaction products are separated from the solid and liquid reaction products in a separating vessel. Part of the paste passed through the apparatus is withdrawn continuously or intermittently at the lower end of the reactor or reactors.

Throughput is increased in a process of this type by operating at temperatures greater than 415°C. and in presence of a fixed catalyst (strongly hydrogenating metal compounds such as sulfides of the heavy metals of the 6th group of the periodic system, or the oxides of the metals of the 5th and 6th groups, preferably in conjunction with sulfides of the metals of the 8th group). Catalysts should have the form of regularly shaped bodies of more than about 3 mm. diameter. Best size of the catalyst bodies depends upon the size of the reactor. Catalyst surface should be as large as possible while still leaving sufficiently wide interstices between the catalyst bodies.

Besides the fixed catalysts there may be added gaseous or volatile substances such as halogens or metalloid halides; or sulfur compounds (CS_2 for instance). The coal itself may be impregnated with a solution of a catalytically acting substance (for example the aqueous solution of a salt of a catalytically active metal). Finely ground catalysts may be added to the coal. Prior to the thermal treatment of the coal it may be subjected to a treatment with an acid for the neutralization of the basic constituents of the ash. The coal paste is heated together with hydrogen in a tubular coil to 270-400°C. and is then passed through an upright tower.

The temperature is allowed to rise gradually or stepwise throughout the entire reaction zone at the rate of 10-100°C., preferably 25-100°C. In the lower part of the reaction zone the temperature is kept below 370°C. (for example, between 270-300°C.) and is allowed to go up to 400°C. or still higher, for instance 450°C. near the upper discharge end of the reactor.

In the example a Mid-German brown coal the ash constituents of which have been neutralized with sulfuric acid, is made into a paste with a residue from a brown-coal tar and in a ratio of 40:60, preheated with hydrogen under a pressure of 300 atm. and passed in the reactor over a stationary catalyst composed of 75 parts of iron sulfide, 22 parts of tungsten sulfide and 3 parts of nickel sulfide, at temperatures between 440 and 460°C. 6% of the liquid reaction product (figured on the amount of coal paste fed into the reactor) is continuously withdrawn. 90% of the coal (figures on ash-free coal) is thus decomposed. The heavy oil obtained contains 2% of asphalt.

TC 1211—German Application I.65,381.

For the production of catalysts of high mechanical strength a wet clay mixture is pressed into the desired form without altering the "stereometric structure" of the clay (particular means not specified) after which the water is removed by slow drying.

TC 1218—German Application H.156,-963.

Externally-heated rotary kilns for the thermal treatment of oil-bearing materials at 500°C. and more are constructed from steel plates analyzing 0.08 - 0.12% C., 0.6-1.2% Mn, 0.25-0.35% Mo and up to 0.2% Si and serving as a backing for an abrasion-resisting steel lining analyzing 0.4% C., 17% Cr and a fraction of 1% of Mo.

The backing consists of a normal structural steel.

TC 1221—German Application J.14,059.

A high pressure angle valve for fluids containing solids, as in pressure hydrogenation or extraction, characterized by the use of a special abrasion resisting valve seat and an engaging valve piston made of a ceramic substance (e.g., carborundum or hard porcelain). The seat is of double frustro-conical form and is held in place by a packing gland. The upper surface of the ceramic seat and the engaging surface of the ceramic valve piston are smooth and flat. If desired the lower part of the double frustro-conical seat need not be of ceramic material.

TC 1222—German Application I.63,810.

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CO and H_2 in a plurality of stages the fresh charge gas is contacted in the first stage with a catalyst which has suffered appreciable loss in activity by use in a succeeding stage.

TC 1225—German Application I.64,241.

In the hydrogenation of CO to hydrocarbons with recycling of liquid hydrocarbons through the catalyst bed, the relatively high boiling hydrocarbon products are withdrawn from the system instead of being recycled, preferably by separation from the hot gases directly at the outlet of the reaction zone.

TC 1228—"Process for Washing Gases to Remove Weakly Acidic Materials"—German Application I.62.938.

When alkaline scrubbing solutions are used, with regeneration by heating, corrosion of steel operating vessels may be prevented by adding to the scrubbing solution small amounts of compounds of right-hand sub-group of 5 group metals, i.e., of arsenic, antimony, bismuth.

TC 1231—German Application (number not given).

Yields in solvent extraction of solid carbonaceous substances (e.g., bituminous coal) under pressure, are increased by using as catalysts metals of the Fe group or compounds thereof, such as Fe_2O_3 or Ni $(NO_3)_2$ together with alkaline substances (NaOH, Na_2CO_3, milk-of-lime). Diluents such as activated alumina and bleaching earth are useful.

Amounts of catalyst used: 0.1-10%.

Composition of the pressure extracts said to be improved.

Solvents used: Benzine, middle oils, low-temperature carbonization tars, particularly coal tars, pressure-hydrogenation products from coals or tars, mineral oil fractions tetrahydronaphthalene.

Oil fractions with boiling point above 200°C, preferably 300°C., are preferred as solvents.

Extraction temperature: 200-500°C., (preferred range 300-420°C.).

Pressure: greater than 20 atmospheres, preferably 50 - 200 atm.

Material to be extracted is preferably preheated in tubular coil.

Extraction is carried out in the presence of scavenging gases (e.g., steam, nitrogen, and small amounts of hydrogen).

Example 1 describes the extraction of a dried peat to which are added milk-of-lime (0.8%) and nickel (1%).

Example 2 describes the extraction of dried brown coal over which a ferric chloride is sprinkled so that coal takes up 0.9% Fe.

Abandoned Applications

S. N. 163,746—"Process for Increasing the Viscosity of Hydrocarbon Lubricating Oils."

H. Goethal, H. Tramm, P. Schaller—Ruhrchemie, A.G.

Treating lubricating oils, particularly paraffin oils as recovered from the Fischer Tropsch process, with ethylene and propylene in the presence of polymerizing catalysts such as aluminum chloride at temperatures below 0°C. preferably about —30°C. under a pressure of 1 to 16 atm., to polymerize 10 to 80% by weight of the olefins. The resulting oil is stated to have high viscosity, low pour point, and low carbon residue.

Board of Appeals ruled no invention.

S. N. 176,659—"Anti Knocking Agents"

Max Landau.

Liquid sulfur dioxide extraction of light hydrocarbons made in oil gas manufacture, the aromatic extract being used as high anti-knock motor fuel.

Finally rejected on art.

S. N. 186,697—"Process for Producing Butandiol—(1, 3)"

Paul Halbig and Alfred Treits.

Butanol—(1)—one—(3) (source not specified) is hydrogenated in aqueous solution over nickel catalyst with hydrogen at 40 atm. pressure at room temperature giving quantitative yield of butandiol—(1,3)

Finally rejected on art.

S. N. 236,029—"Production of Diolefins"

Hans Baehr, Germany.

Monohalogenated saturated hydrocarbons may be treated at 400-800°C., either thermally or in presence of polyvalent metal chlorides, or of "filler bodies" as silicon carbide or coke, to convert to diolefins.

Example: butyl chloride to butadiene about 46% yield, one pass, or 74% by recycling butene.

S. N. 237,464—"Production of Substances Similar to Wax or Petroleum Jellies"

Jahrstorfer, German.

Synthetic vaseline or waxy materials are produced by decarboxylating fatty acid residues, followed by hydrogenation.

S. N. 240,075—"Method for Producing Chlorinated Aliphatic Hydrocarbons"

Hydrocarbons such as methane are chlorinated at 400-500°C. to produce chlorinated hydrocarbons such as tetrachlormethane, by introducing the hydrocarbons into an elongated reaction space containing inorganic fibrous material, such as glass or slag wool, through spaced orifices in central tube. The inorganic fibrous material serves to limit the reaction rate and control the reaction.

Rejected on art and abandoned after second action without prosecution to final rejection.

S. N. 240,150—"Production and Use of Catalysts"

F. Martin & F. Johnswich.

Catalysts for the hydrogenation of carbon monoxide after being reduced are "impregnated" with carbon dioxide which renders them insensitive to air and facilitates handling.

S. N. 242,370—"Catalytic Production of Olefine Oxides"

K. Metzger et al., German.

In producing olefine oxides as ethylene oxide by oxidation over silver catalyst, teaches removal of acetylenes, as by hydrogenation, before reaction.

S. N. 247,468—"Process of Refining Synthetic Fatty Acids"

K. Blass et al., German.

Synthetic aliphatic acids are purified by first forming an ester, metal salt, acid chloride, etc., then heating to 200-350°C. in the absence of oxygen.

S. N. 272,175—"Method of Preparing an Iron Catalyst for Synthesizing Gasoline"

G. Kita, Japan.

2 claims allowed:

Cl. 1. The method of producing an iron catalyst comprising forming a nitrate solution containing metals consisting of 100 parts of iron, 25 parts of copper and two parts of manganese by weight, adding 125 parts by weight of diatomaceous earth and precipitating compounds of said metals on said earth by adding potassium carbonate, washing the precipitate with water and adding thereto 3 parts by weight of caustic potassium, drying the combined precipitate and caustic, adding 20 parts by weight of liquid boric acid to form a resultant product and drying said product.

Cl. 2. An iron catalyst dried from the compound consisting by weight of 100 parts of iron, 25 parts of copper and 2 parts of manganese precipitate from a nitrate solution on 125 parts of diatomaceous earth by potassium carbonate, 3 parts of caustic potassium and 20 parts of boric acid.

A catalyst for Fischer-Tropsch Synthesis.

S. N. 280,055—"Process of Refining Hydrocarbon Mixtures"

F. Martin, German.

11 claims allowed July 16, 1941.

Cl. 1. Process of refining hydrocarbon mixtures, which comprises contacting such hydrocarbon mixture, for the removal of impurities, at a temperature ranging between about 100 and 160°C. with an adsorbent catalytic material which had already been used in the treatment of a similar olefin-containing hydrocarbon mixture at a temperature between about 150 and 400°C. until its capacity of increasing the octane number of this mixture was substantially exhausted.

Correction

In the article entitled "Mercaptan Removal by Unisol Treating Effects Savings in Small Refinery" in the May 3 Technical Section of NPN, p. R-307, it was stated in the second paragraph, "With the Unisol unit the mercaptan content of the gasoline is being reduced from 0.06-0.11% to an average of 0.007% as it leaves the treating unit, and it usually becomes doctor sweet, or nearly so, after a few days in storage".

The sentence should read ". . . . to an average of 0.0007% as it leaves the treating unit . . . . ."

Plant Maintenance Limited to Essential Repairs Because of Labor Shortage

HOUSTON, Texas—The plant maintenance problem for most refiners in the Gulf Coast area, where serious labor shortages confront many industries, involves two factors: (1) lack of workers, both skilled and unskilled, and (2) lack of, or delays in securing, needed repair and replacement parts. Of the two factors the former is considered more important by most refinery managers.

Some refiners declare they have been forced to staff maintenance crews with "anybody who was able to walk in here and had a certificate of availability." Their theory is that whatever work they can get from even inferior quality men is better than none at all—half a loaf being better than no bread. Many of the men hired have come from contractors' crews which were disbanded when work was completed on a project and no other construction was in immediate prospect. Also, some recruits have been secured from the ranks of men leaving construction work because they could see the end of wartime plant construction and they wanted to get in on jobs which will continue after the war ends.

Skilled and Unskilled Men Needed

Some refineries lack unskilled labor; others are after skilled help; still others want both. Many are in particular need of first class mechanics and machinists. It has been learned, however, that some of the recruits who claimed to be trained actually possess neither the training nor the experience to qualify for their nominal rating. These men become dissatisfied when they are not permitted, because of their lack of qualifications, to fill the billet they feel they should have. Some so-called first class pipefitters, for example, have reached their rating solely because of seniority, the fact that somebody had to be up-graded and they happened to be "picked." On the other hand, if they are not "picked" and someone from the "outside" who did have the qualifications is brought in, these men sometimes attempt to make trouble through grievance committees or they quit the job.

Two additional complications which add to maintenance inefficiencies are a "don't-give-a-damn" attitude on the part of some of the men, and lack of proper supervision by their immediate superiors. The unfortunate mental attitude, of course, is the result of the general manpower shortage. The men know they can get jobs elsewhere without major difficulties and at similar rates of pay if they should be dismissed.

Lack of proper supervision from immediate superiors can be laid either to the supervisors' inexperience in handling men, or too much work for which the individual supervisor is responsible.

There are several ways, authorities point out, in which inadequate maintenance can affect the volume of output from the refinery. For one thing, the maintenance work is not done right and some of the jobs have to be done over again, consuming more offstream time for the unit. Lack of sufficient manpower among the helpers for the skilled craftsmen requires even an efficient crew to take a longer time than normal for inspection and maintenance repairs, and again the downtime for the unit is increased.

Another factor bearing on maintenance and the operating efficiency of the plant units is that equipment is "taking a beating," as it is expressed, from inexperienced operators. This applies both to new and old units. More maintenance is required of the equipment so handled, or mishandled. Coupled with this condition is the fact that much of the equipment is being pushed by an increased rate of plant throughput, in order to squeeze every possible barrel of essential product out of the charging stock. In some cases, equipment is now operating at conditions definitely outside of original design limits.

Scarcity of parts is also a factor in the general situation. Sometimes the "ersatz" materials, substitute alloys for example, are "undependable." Two refinery managers gave several examples of increased equipment maintenance caused by failures of substitute materials in replacement parts. The failures were blamed solely on lack of proper alloy for the service. Manufacturers cannot be blamed, because the desired alloy is earmarked by the War Production Board for other types of critical war equipment.

Only Essential Work Done

Two of the most important departures from peacetime custom to "save" manpower have been the elimination of all maintenance frills and scheduling much work not of a vital nature for spare time only. One refiner's discussion of this point is repeated in essence as typical of one of the larger plants.

In 1941, this modern refinery had an operating efficiency of approximately 91%. Now, 100-octane producing facilities have been added to the original setup. Efficiency in 1943 has dropped to about 90% with turn-around time on much of the equipment up as much as 30 to 50%, exclusive of 100-octane equipment. So 1944 efficiency is expected to be down to 85% if present trends of difficulty in securing maintenance manpower continue, and perhaps it will go still lower.

Regular inspection and maintenance have been cut to the bone, according to one plant official, who pointed out that this meant that many jobs which were important but not urgent had been postponed until the men have time to get at them, or until the need for the work does become urgent. Such jobs now postponed will require 600,000 man-hours for completion at this plant alone, it was said.

This refinery has for years carefully scheduled maintenance on all types of equipment and units in the plant. No piece of apparatus was permitted to go for more than three years without inspection and overhaul. Now all equipment which experience has indicated might have been inspected too frequently in the past is scheduled for as few a number of inspections as is considered safe. All regular downtimes and inspections are rigidly scheduled for six months in advance, to avoid two or more units, the larger ones especially, being down at the same time, short of an emergency. At the same time, 60 to 100 unskilled men now are needed full time for maintenance work, with more than that when very large units go down.

Future Maintenance Outlook

There appear to be two possible solutions to the gloomy manpower outlook for maintenance crews. Expectation of some personnel managers is that, as construction projects terminate, men will seek jobs with a postwar future. Others envision some sort of a "share the crew" arrangement between cooperating plants or the use of contract maintenance, especially on the large new 100-octane units. This latter solution is open to a number of objections or complications which now are being carefully studied by management, industry committees, and by the office of the Petroleum Administrator for War.

One refiner's objections may be taken as illustrative:

"We do not see how a 'community plan' will work out. There are some serious problems involved, besides that of possible labor union disapproval. Moreover, how can a contractor hire the men when we cannot, assuming he will pay the same wages we must pay? If he offers higher wages, through 'inducements' or other dodges, he is just robbing somebody of men.

"One serious complication to be faced is that many men, now on contractors' crews, are working for money only; they are not interested in the work. Their work is shoddy. With outside crews coming in, for construction or other work, the discipline problem in our own crews increases markedly. When outsiders have worked with our own men in the past there has been divided authority, duplicated effort and violation of safety rules."

WIDENING HORIZONS

Views on Personnel, Management and Economic as Well as Technological Developments in Petroleum Refining and Natural Gas Processing: Comment from Readers Is Invited

Widespread Postwar Economic Effects From Catalytic Cracking Foreseen

MUCH STUDY HAS BEEN GIVEN in the technological aspects of catalytic cracking, particularly the manufacture of base stocks for aviation gasoline and light hydrocarbons for blending components for the same product. However, in postwar considerations, the economic aspects of this development in refining will also demand considerable attention by refiners. This is discussed in an important article in this issue. (*See p. R-334.*)

The wide use of catalytic cracking after the war will make possible greater proportionate output of gasolines and distillates from crude run to stills, at the expense of residual fuel oils. The limited data now available also indicate that the properties of the distillate fuels from catalytic cracking will differ from those of similar products from straight refining operations. The principal volume markets of these distillate fuels are as household heating oils and as Diesel fuels. In certain grades of distillates from straight refining, the same product has been marketed satisfactorily both as a heating oil and for Diesel engine fuel. The information now available indicates that distillates from catalytic cracking may not fill this dual role, particularly without further processing and treating which may not be economically practicable.

The wartime conditions under which the "cat crackers" have been installed will accentuate these postwar developments in general. As of June, 1943, close to 900,000 barrels daily charging capacity of catalytic cracking facilities had been installed or was authorized, in many refineries over the country. Under the oil industry's wartime expansion program these installations in most cases were in addition to the thermal cracking capacity which already existed at the refinery. Under normal conditions these catalytic units would have been installed over a considerable period of years, to replace the older cracking units.

To a limited extent the non-catalytic capacity has been reduced by the conversion of a refinery to catalytic cracking, the thermal cracking equipment being used for rerunning or treating. Also some of the thermal plants operated now to meet wartime demands will not be used after the war. At the same time, however, additional catalytic cracking capacity will be installed in future years in some of the 200 and more refineries which were not included in the wartime construction program. The net effect could easily be that the industry will have within a relatively short time after the war total charging capacity for cracking plants of over 3,000,000 b/d. The catalytic units also are more flexible in their operations to produce large proportionate volumes of either gasoline or distillate fuels, as market demand may warrant. It should be borne in mind that, despite the large volume of this total cracking capacity, a good part of it is already obsolete and will be replaced under normal conditions.

An insight into the postwar economic effect of catalytic cracking is given in the article referred to above. The authors set up, for the various refining districts in the country, the percentages of idle cracking capacity, for plants with both catalytic and non-catalytic facilities, when running their 1940 volume of crude. Substantial idle capacity is shown in both types of equipment. For the entire country the 1940 crude demand can be taken as more nearly in line with crude requirements for the immediate postwar years than the present crude runs, which are nearly 25% larger, due to extensive military requirements.

'Cat Crackers' Compete for Gas Oils

An immediate rather than postwar development resulting from the installation of catalytic cracking has to do with the supply and characteristics of heating oils and Diesel fuels. Charging stocks for the catalytic units, on the basis of present operations, are the distillate gas oils from topping and straight refining operations. These are also marketed as heating oils and Diesel fuels. Thus the "cat crackers" in effect are in competition for these products with an already established large volume consumer demand.

Satisfactory grades of heating oils and Diesel fuels can be manufactured by catalytic cracking but at present their properties, except after further processing and treating, do not make them as desirable as the products from straight refining, it is considered. After the war it is evident that there will be a considerable increase in the proportion of heating oils and Diesel fuels from catalytic cracking. Their satisfactory utilization may create the economic as well as technological problems of further improving the products themselves.

This possibility is already recognized as it affects domestic heating oils. Committees representing both refiners and burner manufacturers have started to consider what changes in specifications for the oils or possibly in design of burners may be required to meet this situation. A memorandum setting forth the basis for their discussions states: "The trend toward higher octane gasoline and wider use of the catalytic cracking process tends to produce lower A.P.I. gravity distillate fuels for the same distillation range and residual fuel oils of different gravity-viscosity relationships than have previously been available."

"The petroleum industry wants to continue to serve heating needs," the memorandum continues, "but as a result of changes in refinery practices such needs can be served more economically if heating equipment is designed to utilize the lower A.P.I. gravity, higher heat content fuels in each distillation range, which will be available in increased proportions."

As regards Diesel fuels from catalytic cracking, it also is difficult to forecast the properties these products may have in postwar refining, because the units at present are run to manufacture aviation gasoline. One authority has stated that catalytic cracking units operated to produce motor gasolines should give yields of distillates which on recycling will make better Diesel fuels than those secured from thermal cracking.

The stability in storage of heating oils and Diesel fuels from catalytic cracking is another important subject for both refiners and distributors to study. It also serves to illustrate the wide extent to which catalytic cracking is destined to affect petroleum refining in its postwar operations.

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Contents

Vol. 36, No. 23—June 7, 1944

Coordinated Maintenance Program Improves Units' On-Stream Time R-329

Effect of Catalytic Cracking on the Postwar Supply of Motor Gasolines and Fuel Oils. By W. G. Moore and T. G. Elder R-334

How Will the New Processes Affect the Postwar Light Ends Situation? By D. P. Barnard and J. H. Forrester R-342

Process Design for the Synthetic Rubber Plants. By G. E. Kopetz R-348

Key Technologists in the New Wartime Plants R-360

Economic Design of Pressure Vessels. Article 2—Shape of Heads. By E. F. Brummerstedt R-362

Butadiene by Thermal Cracking of Naphtha Included in California Rubber Project R-366

Thermal Properties of Hydrocarbons. (Article 2 in a Series). By J. F. Fallon and K. M. Watson R-372

Book Reviews R-375

Wartime Refining Brings New Corrosion Problems

Refinery Corrosion Problems Reviewed. By Ivy M. Parker R-376

Uses of Clad Steels to Combat Corrosion. By Martin J. Conway R-378

Use of Nickel Alloys to Resist Corrosion. By B. B. Morton R-381

Stability of Butadiene. By Richard F. Robey, Herbert K. Wiese and Charles E. Morrell R-384

Centralized Control is Feature of Refinery Protective System R-390

Alien Patents Available to U. S. Industry Cover Many Petroleum Refining Processes R-394

Widening Horizons R-408

INDEX TO ADVERTISERS

Technical Section

This index is published as a convenience to the reader. Every care is taken to make it accurate, but National Petroleum News assumes no responsibility for errors or omissions

American Cyanamid & Chemical Corp. R-399

Alcorn Combustion Co. R-401

American Meter Co. ..... R-356—R-357

Atlantic Refining Co. R-365

Babcock & Wilcox Tube Co. R-371

Brooks Equipment & Mfg. Co. R-405

Clark Bros R-383

Consolidated Engineering Corp. R-393

Cooper-Bessemer Corp. R-337

Fluor Corp. R-391

Foster Wheeler Corp. ..... R-340—R-341

Foxboro Co. ..... R-350—R-351

General Chemical Co. R-377

Graver Tank & Mfg. Co., Inc. R-347

Johns-Manville Corp. R-387

Lummus Co. ..... Insert

Marley Co., Inc. R-353

Monsanto Chemical Co. R-397

Porocel, Corp. R-365

Universal Oil Products Co. R-367

Union Asbestos & Rubber Co. R-361

Warren Petroleum Corp. R-389

Wyatt Metal & Boiler Works ..... Outside Back Cover

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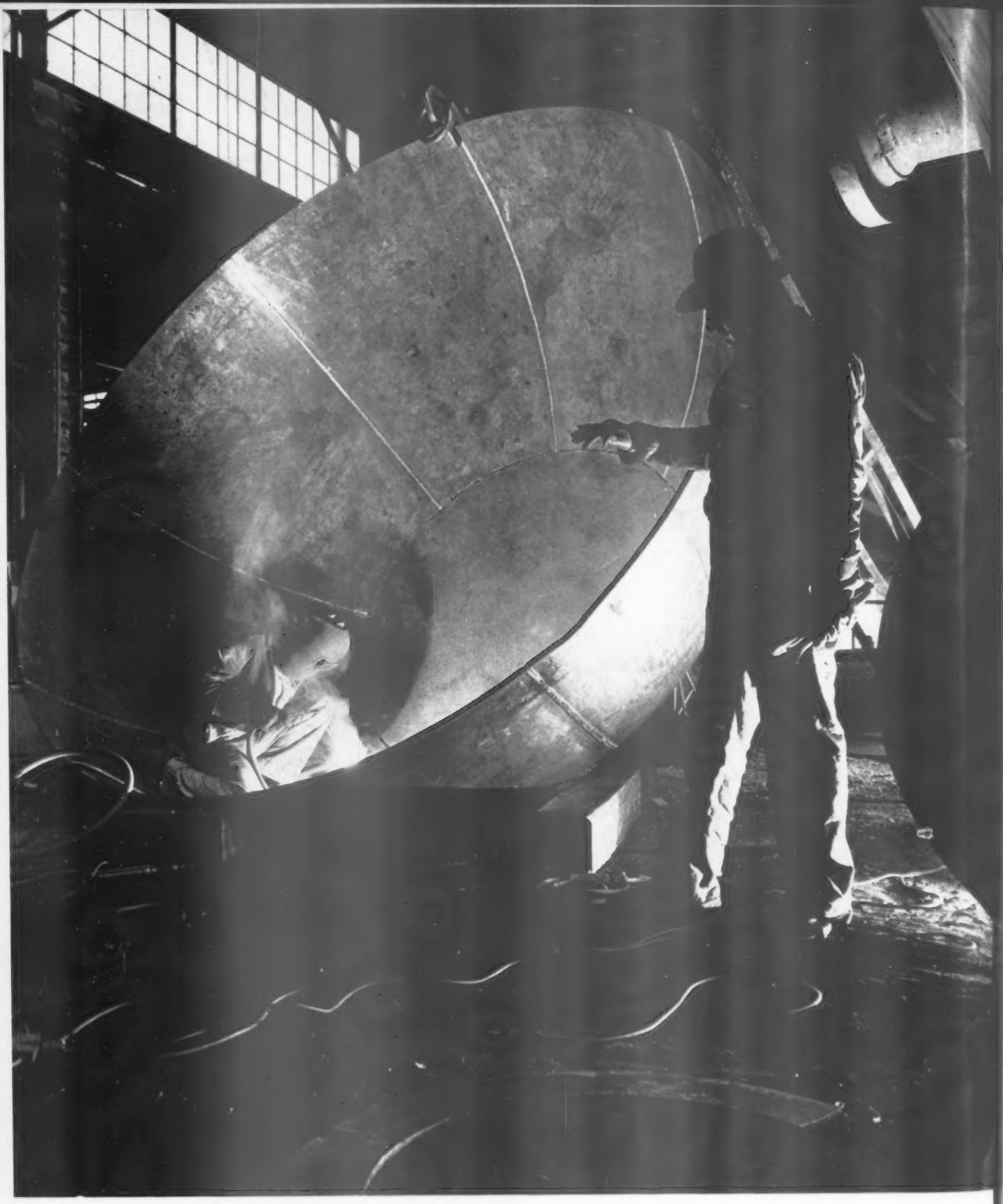

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